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Interlake Site Chicago, Illinois

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US EPA RECORDS CENTER REGION 5



408502

*Quality through
teamwork*

Rust Environment & Infrastructure

**INTERLAKE SITE
SUMMARY REPORT
AND SUPPLEMENTAL WORK PLAN
CHICAGO, ILLINOIS**

Prepared for:

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1.0 INTRODUCTION

Rust Environment & Infrastructure (Rust), on behalf of Waste Management of Illinois, Inc. (WMII), has prepared this report to summarize the results of various previous investigative activities at WMII's property known as the Interlake Site (the Site). WMII has conducted environmental assessments at the Site and is presenting this Site summary report in accordance with the Illinois Environmental Protection Agency (IEPA) Pre-Notice Cleanup Program.

This report summarizes the activities presented in three reports previously submitted to IEPA by WMII and presents WMII's recommendations for future activities at the Site and a proposed schedule to implement the recommended actions. This report also summarizes the results of data gathered at the Site by various State of Illinois agencies and United States Environmental Protection Agency (USEPA).

1.1 IEPA SITE REGISTRATION AND GENERAL INFORMATION

The Site is registered with the IEPA as the Interlake Landfill Site. The IEPA Site Number is 0316000025. No operating permits have been issued for this Site by the IEPA or the USEPA.

1.1.1 Site Location

The Site is located east of Lake Calumet in Cook County, Illinois and within the corporate limits of the City of Chicago (see Figure 1). The Site is approximately 14 miles south of downtown Chicago and lies within a large industrial belt along the south shore of Lake Michigan. The Site is approximately 280 acres in size and bounded by the 116th Street right-of-way to the south, the 110th Street right-of-way to the north, the Stony Island Avenue to the west, and the Norfolk and Western Railroad spur on the east. Geographically, Lake Calumet lies to the west, the Norfolk and Western Railroad yard is to the north, Acme Steel, Inc. is to the east, and Paxton Landfill is located south of the Site.

1.1.2 Program Participant Information

The following program participant information is provided:

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1.2 BACKGROUND INFORMATION

1.2.1 Ownership and Previous Use

WMII purchased the Site in 1981 from the Interlake Companies, Inc. (Interlake) and other parties. WMII had purchased the Site for future development as a landfill but no longer plans to permit the Site as a landfill.

The southern and eastern portions of the Site were previously used by Interlake for landfilling of by-products from their steel-making and coking operations. The northeastern portion of the Site was used for mining of sand and gravel. The northwestern portion of the Site was used for the disposal of construction debris and the north-central portion of the Site was previously an automobile junkyard. The eastern portion of the Site along Stony Island Avenue has, historically, been plagued with the illegal dumping of debris including: automobiles, appliances, building materials, household refuse, etc (Figure 2).

Approximately 87 acres of the central portion of the Site has been defined as a wetland by the U.S. Army Corps of Engineers Special Area Management Plan for the Lake Calumet Region.

1.2.2 Surrounding Area Land Ownership and Use

The Site is bordered on three sides by heavy industry. The west side of the Site is bordered by Lake Calumet. To the north is a railway switching yard operated by Norfolk and Western Railroad; to the east is a coking operation formerly operated by Interlake and presently owned and operated by Acme Steel, Inc.; and to the south is the Paxton Landfill. Another landfill, the Land and Lakes Landfill, is south of and adjacent to the Paxton Landfill. Northeast of the Site is the Metropolitan Sanitary District (MSD) Landfill which was recently closed. All of these industrial operations are potential sources of contamination at the Site.

The Norfolk and Western Railroad property is utilized for a variety of railroad operations. Listed below are general railroad operations currently being performed on this property:

- Locomotive maintenance.
- Bulk petroleum and lubricant storage.
- Railroad tie storage.

Acme Steel, Inc. (previously operated by Interlake) operates the coking facility to the east of the Site. Listed below are operations at the Acme Steel, Inc. facility:

- Bulk coal storage.
- Coke production.
- Machinery maintenance.

The Paxton and the Land and Lakes Landfills are currently open and accept municipal and industrial wastes for disposal.

The MSD Landfill has been closed and is now operated as a golf course.

1.3 TOPOGRAPHY, GEOLOGY, AND HYDROGEOLOGY

1.3.1 Topography and Surface Water Drainage

The Site is relatively flat. Eighty-seven acres in the northern and central portions of the Site are classified as wetlands. The southern portion of the Site is composed of general fill material. The dryer portions of the Site are covered with native grasses and wildflowers as well as some trees.

Previous use of the Site has created a substantially altered terrain. It is estimated that the current topographic elevation of the Site is approximately five feet above its unaltered, natural elevation.

Surface water drainage at the Site is generally south-southwest and toward Lake Calumet. The watershed area that drains onto the Site is delineated on Figure 5.

Indian Treaty Creek enters the Big Marsh through the 36-inch corrugated metal pipe (CMP) under the railroad as shown on Figure 2. The inlet of the CMP is known to be clogged to near full depth with railroad ties and sediment which has inhibited flow through the culvert. This 36-inch CMP is the only surface water inlet to the Big Marsh wetland. The culvert is situated on the right-of-way owned by the Norfolk and Western Railroad.

Downstream of the 36-inch CMP, Indian Treaty Creek enters the Big Marsh. Approximately 75 acres of the Big Marsh is open water. The depth of the open water portion of the Big Marsh currently ranges from approximately 1 to 4 feet and proves a suitable wetland habitat for breeding populations of many rare, threatened, or endangered shorebirds, waterfowl, and marsh birds. Water levels in the Big Marsh are currently controlled by a water level control structure. Base flows (2 to 5 cubic feet per second) normally travel from the Big Marsh to the Southwest lagoon through a 24-inch culvert with a water-level-controlling stop log structure installed as a part of a wetland enhancement project.

Surface water travel through an outlet installed in the water level control structure from the Big Marsh into the Southwest Lagoon. The Southwest Lagoon open water wetland occupies about 8 acres. The Paxton landfill lies just south of the Southwest Lagoon. A perimeter swale system largely prevents conveyance of runoff from the Paxton Landfill into the Southwest Lagoon.

Topographic mapping obtained in 1992 and 1982 indicates the area just east of the Southwest Lagoon and north of the Paxton Landfill does not contribute surface water runoff to the Southwest Lagoon.

Surface water exits the Southwest Lagoon through a swale which parallels the east side of Stony Island Avenue. The swale conveys flow to a twin 36-inch (CMP) culvert under Stony Island Avenue. The culvert discharges directly into a small area of Lake Calumet. The bed of the swale upstream from the twin 36-inch CMP has been filled with sediment to the point where the inlet of the twin 36-inch CMP is clogged to almost full depth with sediment and railroad ties. The sediment and debris clogging the swale and culverts has been reported to back water up into the Southwest Lagoon.

1.3.2 Geology

The geology of the Site was defined during Canonie's advancement of 28 borings to various depths and reported in Hydrogeologic Investigation, Interlake Site, Chicago, Illinois; prepared for Waste Management Inc., Oak Brook, Illinois; prepared by Canonie Engineer; dated June 1982.

The fill areas generally drain through to an undisturbed sand layer (what remained after mining) which is underlain by an unconsolidated till layer. The thickness and lateral distribution of the undisturbed sand layer is depicted in geologic cross-sections A-A to D-D, Figures 14 to 17 of the Canonie (1982) report. The sand layer is thickest near boring B-7 where it is approximately 20 feet thick but averages approximately 5 feet thick across the site. In localized areas of the site, the sand layer has been completely removed by mining. Backfill materials lie directly on the Tinley till at these areas. The unconsolidated till is characterized by sand, silt, and clays. In some areas of the Site, as was reported in the Canonie report (June 1982), the silts and clays exhibit permeabilities characteristic of fine grained soils. Stratified drifts comprised of coarser grained materials are common at the base of each till layer. The stratified drifts are ice channel deposits and are generally discontinuous, seldom yielding large amounts of water. Canonie (1982) reported in-field hydraulic conductivity values calculated from test borings drilled at the site in the Tinley and Valparaiso tills at 9×10^{-8} and 9×10^{-9} cm/sec, respectively. Duwal (1989) calculated an in-situ hydraulic conductivity of 5.9×10^{-4} from falling head test done on groundwater monitoring well MW-2 installed in the glacial till at the site. Although well yields were not specifically reported in either investigation, the well yields corresponding to hydraulic conductivity values in this range are anticipated to be low. As previously mentioned, detailed presentation of the Site geology is given in Hydrogeologic Investigation, Interlake Site; Canonie Engineers, June 1982.

1.3.3 Hydrogeology

The hydrogeology of the Site was defined through the installation and evaluation of data from 20 Site monitoring wells and piezometers and reported in Hydrogeologic Investigation, Interlake Site, (Canonie, 1982).

Shallow groundwater in the unexcavated sands and fill flows west-southwest toward Lake Calumet. The gradient across the Site is relatively flat. Due to the flat horizontal gradient and lack of a

vertical gradient, groundwater flow rates across the site are slow. The rate of flow of the groundwater was not reported for the unexcavated sands and fill in the Canonie (1982) or the Duwal (1989) reports, however, Duwal states that "the velocity of the groundwater flow is usually very slow, on the order of less than a meter per day." Duwal also describes the possibility that the heterogeneous nature of the fill may provide conditions for preferential flow paths in the fill where the flow velocity is higher.

The groundwater flow pattern at the Site was established and reported in the Canonie report (June 1982). The Illinois State Water Survey (ISWS) has been interested in determining the relationship between shallow groundwater levels and surface water levels at the Site. The study that the ISWS sponsored, Event-Based and Seasonal Precipitation Effects on Shallow Groundwater - Wetlands Interactions Near Lake Calumet, Southeast Chicago, Illinois, Kenneth Duwal, 1989, (Appendix E) shows that each of these water levels are directly related (as the surface water level drops so does the shallow groundwater level). Surface water is in direct connection with the shallow groundwater.

Figure 3 shows the piezometric surface map of the bedrock aquifer. The piezometric map was developed by Canonie (1989) from groundwater elevations measured in wells installed in the bedrock below the unconsolidated deposits across the site. The map depicts the gradient and flow direction within the confined bedrock aquifer.

The bedrock piezometers currently have a historical water quality database. As described in Section 2.1.1, groundwater samples collected in 1989 (IEPA) and 1982 (Canonie) from wells installed in the unconsolidated deposits and within the Silurian dolomite bedrock beneath the site did not exhibit contamination above regulatory thresholds. Contaminants detected were attributed to contamination of the drilling fluid (benzene, Canonie, 1982) and upgradient off-site sources (acetone, IEPA, 1989). Cravens and Zahn (1990) sampled one of the bedrock wells on site as part of a water quality study performed by the Illinois State Water Survey for the Lake Calumet area. No contaminants were detected in this groundwater sample. One of the conclusions of this report for the Lake Calumet area was:

"Although inorganic and organic contaminants have been detected in a few samples from the Silurian dolomite aquifer in both water-supply wells and monitoring wells, the contamination is not attributable to natural ground-water transport through geologic materials overlying the bedrock aquifer."

The reason given for not attributing the contamination detected in the off-site bedrock wells in the Lake Calumet area to contamination above the aquifer was the presence of the thick till sheets which overlie the bedrock. Scattered instances of contamination detected in off-site bedrock wells in the Lake Calumet area were attributed to cases where man-made breaches in the till sheets allowed access to the bedrock. Since the Tinley and Valparaiso tills are intact at the site, they are a natural barrier to flow into the deeper bedrock unit. Field hydraulic conductivity testing performed by Canonie (1982) indicated low permeabilities for these two tills (9×10^{-8} and 9×10^{-9} cm/sec, respectively). These low hydraulic conductivity values provide further indication of the confining properties of the tills overlying the Silurian bedrock at the site.

As previously mentioned, a detailed description of the Site's hydrogeology is presented in Hydrogeologic Investigation, Interlake Site; Canonic Engineers, June 1982.

2.0 PREVIOUS REPORTED ACTIVITIES SUMMARY

Since 1982, WMII has contracted with various companies to complete work at the Site. This work includes:

- A hydrogeologic investigation completed by Canonie Engineers in 1982;
- Analysis of groundwater samples completed by WMII's Environmental Monitoring Laboratories (EML);
- A geophysical investigation completed by ICF Kaiser Engineers in 1990;
- Sampling of surface and groundwater and a waste delineation study completed by Integrated Sites, Inc in 1992; and
- Surface water and sediment sampling and a waste delineation study completed by Rust Environment & Infrastructure in 1994.

Information from each of these activities has been previously presented to the IEPA and is summarized in this report. Additional information which is summarized in this report has been taken from the USEPA Screening Site Inspection (SSI) Report and IEPA reports regarding water quality and background conditions for inorganic compounds in soil at the Site and in the Lake Calumet area. Also included in this report, is site hydrogeologic information which was collected and published by Kenneth G. Duwal. Mr. Duwal conducted a study at the Site which related event and seasonal precipitation effect on the Site groundwater and Site Wetlands. This study, Event-Based and Seasonal Precipitation Effects on Shallow Ground Water-Wetlands Interactions Near Lake Calumet, Southeast Chicago, Illinois; Kenneth G. Duwal; B.S., University of Illinois at Chicago; 1989, is provided in Appendix E of this document.

2.1 GROUNDWATER SAMPLING

Past activities at the Site included the installation of 20 groundwater monitoring points. These monitoring points include both shallow zone and deep zone monitoring wells. To fully characterize the groundwater at the Site, these monitoring wells have been sampled, sporadically, since their installation in 1982. Figure 2 shows these groundwater monitoring well locations. Table 1 provides a summary of the well construction details and Table 2 provides a summary of the sampling activities that have been completed at each of the wells.

2.1.1 Groundwater Sampling Results

Groundwater at the site has been sampled since 1982. The groundwater samples were initially analyzed by Canonie. Groundwater samples were also collected and analyzed by the IEPA and USEPA for various purposes. Table 3 summarizes the analytical results of the groundwater sampling activities.

Based on the results of past investigations at the Site (Canonie and USEPA), it has been determined that groundwater enters the Site from the northeast, northwest, and southeast, and flows to the south-southwest, generally towards Lake Calumet. The shallow groundwater flow in the

unconsolidated deposits is shown on Figure 4. The deeper portion of the groundwater follows the contours of the bedrock surface which indicates a flow towards the south-southeast. Figure 3 depicts groundwater flow at the bedrock surface.

Based on the reported groundwater flow direction, groundwater monitoring well nests ST-2 and ST-3 are located upgradient of the Site and monitor the quality of the groundwater flowing towards the Site. The analytical results from samples obtained from monitoring well nests ST-2 and ST-3 indicate that the volatile organic compound (VOC) acetone, detected in wells ST-2D, ST-3D, and SS-2D, most likely results from an upgradient and off-site source. Also, the 1982 groundwater sampling event detected benzene above the IEPA Class I Groundwater Remedial Objectives. Benzene was measured in all wells in 1982 including the background well. The presence of benzene in the background well sample in 1982 indicates that the benzene was likely due to contamination either in the sample bottles or at the laboratory. A second groundwater sampling event performed in 1989 did not detect benzene in any of the groundwater samples.

During the 1989 groundwater sampling event, one semi-volatile organic compound (SVOC) was measured in three site monitoring wells (ST-2D, ST-2D, and SS-1D). This SVOC, bis-2 ethylhexylphthalate (BEHP), is a common laboratory analytical equipment plasticizer and when detected at low levels, is generally attributed to laboratory contamination. In these three monitoring wells, BEHP was detected at low levels and, therefore, was attributed to probable laboratory contamination of the samples.

Inorganic compounds detected during groundwater sample analysis are within State of Illinois acceptable limits as established by the ISWS as background conditions for the Chicago metropolitan area.

Appendix A contains copies of the analytical results of groundwater sampling performed at the Site and presents analytical results for samples collected by Weston for VOCs, semi-volatiles, pesticides, and inorganics and split samples for VOC analysis collected by WMII. Tables providing the IEPA Class I Groundwater Remedial Objectives are provided in Appendix D.

2.2 SURFACE WATER SAMPLING RESULTS

Surface water at the Site has been sampled since the 1980s. The surface water has been characterized by ICF Kaiser, Integrated Sites Inc., and Rust. Surface water samples were also collected and analyzed by the IEPA for a USEPA CERCLA Site Screening Inspection (SSI), for a hazard ranking, and for confirmation sampling. The surface water sampling point locations are shown on Figure 2. Table 4 provides a summary of the analytical results of the surface water sampling performed at the Site.

Surface water enters the Site from two areas along the northern border of the Site. Surface water samples were collected at: SW-4 where the Indian Treaty Creek enters the Site; and SW-7 and SW-12 where a drainage channel enters the Site. Surface water inlets and surface water sampling locations are shown on Figure 2.

No VOCs or SVOCs were detected in surface water samples from these locations at levels above the State of Illinois Water Quality Standards for Class III Special Resources Groundwater (Appendix D). Surface water sampling did indicate sporadic exceedence of four inorganic compounds, as follows:

- One exceedence for cyanide in 1990;
- One exceedence for chromium IV in 1990;
- One exceedence for mercury in 1990; and
- One exceedence for lead in 1991.

The multiple exceedences for the inorganic compounds boron, ammonia (unionized), and iron can be attributed to Interlake's disposal of slag and steel making by-products at the Site. Boron is a compound typically used in the hardening of steel. Iron would be an expected component of the slag present at the Site. Ammonia was used in the gasification process in the coking ovens. Ammonia may also occur naturally as decaying plant material is washed into the surface waters of the Site.

Appendix B contains the results of the surface water sampling conducted at the Site. Appendix B presents each sampling event arranged in chronological order. Tables providing the IEPA's Water Quality Standards are provided in Appendix D.

2.3 SOIL AND SEDIMENT SAMPLING RESULTS

The soil and sediment have been sampled at the Site since 1982. Soil samples were collected and analyzed by Canonie Engineers during their hydrogeologic investigation, during the USEPA SSI and during the ICF Kaiser investigation. The location of soil and sediment sampling points is shown on Figure 2. Table 5 summarizes the results of the soil and sediment sampling and compares those results to the regional background levels and to the IEPA's Soil Remediation Objectives.

Generally, the inorganic compounds measured in the soils and sediments at the Site fall into the established range of background conditions for the Chicago Metropolitan Area. The background conditions for this area are presented in Table 2 of the IEPA publication IEPA/ENV/94-161, A Summary of Selected Background Conditions for Inorganics in Soil. There were two inorganic compounds measured above the published background conditions at the Site. Selenium was measured once at a concentration of 4.6 mg/Kg at sampling point X-101. The published background range for selenium is from <0.12 mg/Kg to 2.6 mg/Kg. Cyanide was measured at a concentration of 4.2 mg/Kg at sampling point X-107, 3.37 mg/Kg at SW-4, and 2.81 mg/Kg at sampling point SW-12. The published background range for cyanide is from <0.07 mg/Kg to 2.7 mg/Kg. The IEPA soil remediation goal for cyanide is 0.2 mg/l as measured by TCLP testing. Analytical results for soil and sediment samples X-101 to X-108 were collected by IEPA in 1989 and analyzed for VOCs, semi-volatiles, PCB pesticides, and inorganics. Sediment samples were collected in 1994 by WMII and analyzed for cyanide. Both sets of analytical results are presented in Appendix C. Based on the 20 times dilution factor, which is inherent in the TCLP method, the observed soil and sediment cyanide concentrations would be diluted below IEPA Soil Remediation Objectives. The process of changing a contaminant concentration of a solid to a contaminant concentration in 2 liters of liquid results in a lowering of the concentration by a factor of 20. Assuming complete leaching occurs

during the TCLP procedure so that all of the contaminant in the solid leaches into the liquid, the solid concentration will be diluted by a factor of 20 in the resulting liquid. Incomplete leaching would result only in a lower concentration in the liquid. Therefore, it is logical to assume that TCLP results would be lower than the concentration of total metals in the soil and sediment.

Ten SVOCs were detected in soil and sediment samples collected during the IEPA SSI (samples X-101 to X-108). With the exception of benzo (a) anthracene, chrysene, and benzo (k) fluoranthene, these SVOC concentrations are within an order of magnitude of the IEPA's Soil Remediation Objectives. Additionally, as these SVOC analytical results are over 6 years old, it is possible that these SVOC concentrations are now lower due to natural biodegradation and may have degraded to levels which no longer exceed regulatory threshold values.

No VOC concentrations were measured in any of the soil or sediment samples above the laboratory method detection limits or above the IEPA's Soil Remediation Objectives.

The results of the soil and sediment sampling conducted at the Site are presented in Appendix C. The results of each sampling event are presented in chronological order. The tables providing the IEPA's Soil Remediation Objectives, proposed 742 rules (Tiered Approach to Cleanup Objectives), and the IEPA's report on inorganic background conditions are provided in Appendix D.

2.4 GEOPHYSICAL TESTING

A geophysical (electro-magnetic) survey of the Site was completed by ICF Kaiser in 1990, to identify areas of previous land-filling at the Site. The electro-magnetic survey determined there were anomalies in three different areas. These areas are labeled as Areas A, B, and C and are shown in Figure 2. These areas were investigated further by the use of Test Pits. Integrated Sites, Inc. investigated Areas A and B, and Area C was investigated by Rust.

The results of the test pits advanced in Area A showed that this area had been used mainly as a disposal area for slag and other bi-products from Interlake's steel manufacturing processes. Some burned municipal waste was also documented in the test pits from Area A. A TCLP analysis of white material collected from one test pit located in Area A resulted in a benzene concentration of 2.8 mg/l (Integrated Sites, 1991) which is above the soil cleanup standard for benzene of 0.5 mg/l.

The results of the test pits advanced in Area B determined that "tar like" material was present in five of the nine test pits based on qualitative visual observations. The test pits which contained "tar like" materials are shown in Figure 2 of the Integrated Sites Workplan (1991). The four test pits that did not have "tar like" materials present generally had a surface layer of red dust (believed to be waste from the iron and steel production), underlain by construction debris and burned municipal waste or slag, which was underlain by peat. Section 3.2.4, Investigation of "Tar Like" Materials, presents the proposed future activities for this area.

The results of the six test pits advanced in Area C determined that no materials of concern (i.e., - buried containers) were present.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 CONCLUSIONS

3.1.1 Groundwater

Groundwater enters the Site from the northeast and northwest. The shallow groundwater, sampled during 1982, detected the presence of benzene above State of Illinois Class I groundwater standards (Canonie, 1982). However, groundwater samples taken from the background water well (shown as BG-1 in Table 3) also detected benzene in concentrations above these standards. Therefore, the presence of benzene in these samples is likely to be from contaminated sample containers or from laboratory interferences.

Deep groundwater enters the Site from the northeast. Based on this, deep groundwater sampled from wells ST-2D, ST-3D, and SS-1D is believed to be representative of the quality of groundwater entering the Site. As was shown in Table 3, exceedances of IEPA groundwater standards are due to contaminated groundwater entering the Site. Therefore, it is WMII's opinion that the past activities at the Site have not impacted the Site's groundwater.

3.1.2 Surface Water

Based on the IEPA's Water Quality Standards, concentrations of inorganic compounds have been exceeded in the Site surface waters. No IEPA standards were exceeded by the VOC or SVOC detections in the Site surface waters.

The highest levels of inorganic compounds were measured at sampling points SW-4 and SW-12. Sample point SW-4 is located where Indian Treaty Creek flows into the Big Marsh. Sample point SW-12 is where a drainage ditch discharges surface water from the area north of the Site into the Big Marsh.

Elevated ammonia concentrations can be related to the seasonal growing cycles. Ammonia was measured at its lowest during the end of the growing season and measured at it highest just before the start of the growing season. This correlates with cyclic plant uptake of ammonia during its growing season and the ammonia being released back into surface water from decaying plant life.

The occurrence of the inorganic compound boron in the surface water may be associated with the by-products from the production of iron and steel found at the Site. Boron is typically used in the steel hardening process. Boron was detected at seven of the twelve surface water sampling points. However, the greatest boron concentration was found at sampling point SW-4, which is where the Indian Treaty Creek enters the Site. With the exception of one detection (out of seven sampling events) at SW-5, and the detections at the SW-4 sampling location, all other boron levels are within 0.5 mg/Kg of the IEPA's Water Quality Standards (1.0 mg/Kg).

Cyanide and mercury were detected only at sampling point SW-12. As previously stated, SW-12 is the point where an off-site drainage ditch empties into the Big Marsh.

The detections of iron (both dissolved and total) are within 1 mg/Kg of the IEPA water quality standard of 0.5 mg/Kg for dissolved iron and 1.0 mg/Kg for total iron. These values for iron also fall into the background surface water condition range established by the IEPA for the Lake Calumet region.

3.1.3 Soil/Sediments

Soil/sediments at the Site were found to have SVOC concentrations exceeding the IEPA's Soil Remediation Objectives. The presence of these SVOCs is consistent with Interlake's previous disposal practices at the Site. However, as there is no evidence that these SVOCs have impacted the groundwater, and as past disposal practices at the Site ended before 1980 these SVOCs either have naturally degraded or are naturally degrading and are most likely no longer present above the IEPA Soil Remediation Objectives.

3.2 RECOMMENDATIONS

The following subsections detail WMII's recommendations for future work at the Site. These recommendations are proposed to provide an update of the Site groundwater and soil characterization and to provide data which may be necessary to develop remedial or corrective action plans for the southwestern Site (delineated in Figure 2), if required. WMII is proposing that these recommendations be implemented, as necessary, so that the IEPA may evaluate the issuance of a "No Further Action Required" letter (also known as a "4Y" letter) for the southwestern portion of the site.

After IEPA approval of this summary report and supplemental workplan, WMII will implement the workplan in accordance with the schedule present in Section 4 of this report.

3.2.1 Groundwater Monitoring

Prior to performing any additional groundwater sampling, a well inventory will be performed on the wells to be sampled (Table 6). Damaged or otherwise unusable wells will be abandoned, replaced, and developed prior to sampling.

WMII proposes that two supplemental rounds of groundwater samples be taken bi-annually for 1 year at the Site to update the water quality database. Groundwater samples are proposed to be taken from the monitoring wells and analyzed for the parameters shown in Table 6. Any compounds not detected in Round 1 will be deleted from the analyte list for Round 2. If an analysis of a groundwater sample collected from a well during Round 1 results in all nondetects, the well will not be resampled for Round 2. The groundwater monitoring wells to be sampled are located in the southwestern portion of the site. To address the potential impact of the "tar like" materials on the groundwater in the southwest corner of the site, an additional water table groundwater monitoring well will be installed approximately 200 to 300 feet north of ST-4S and D nest, developed and

sampled bi-annually for 1 year (for a total of two sample rounds) along with other wells identified in Table 6. The method detection limits for the analytical parameters will be at or below the IEPA Class I Groundwater Remediation Objectives (Appendix D).

All monitoring wells selected for sampling will also be sampled for field parameters of temperature, pH, and conductivity. Water levels will also be taken to evaluate if the groundwater flow pattern has changed in the Site area since 1989.

3.2.2 Surface Soil Sampling

WMII proposes that surface soil sampling be conducted in areas of the southwestern portion of the site where visual signs of stressed vegetation exist. This surface soil sampling is proposed to be performed to verify if the VOCs and SVOCs previously detected at the Site have degraded to levels below the IEPA's Soil Remediation Objectives. These surface soil samples will be analyzed for the parameters which exceeded the IEPA's Soil Remediation Objectives during the USEPA SSI. These surface soil samples will be analyzed for the VOC and SVOC parameters using USEPA Methods 8240 and 8270, respectively.

3.2.3 Investigation of "Tar Like" Materials

WMII proposes to define the vertical and horizontal extent of the area of "tar like" material apparent at the ground surface in Area B. The data gathered from this investigation would be utilized to evaluate remedial alternatives for this area. WMII would define the extent of the "tar like" materials by excavating test pits in this area. Conceptually, this investigation would involve the excavation of up to six test pits in this area. The extent of the "tar like" materials would be verified through visual observation of the excavated material. One composite sample from the area will be submitted for waste disposal testing (profiling).

3.2.4 Risk Assessment


If necessary, WMII proposes to perform a risk assessment for the Site based on the anticipated future use of the Site. Risk assessments would be performed for fish and wildlife use. Additionally, a human health risk assessment, utilizing the trespasser scenario is proposed. The results of the risk assessments will be utilized, if necessary, to determine remedial or corrective action goals based on the Site's future use.

3.2.5 Remedial or Corrective Action Plan Development

Based on the results of the proposed risk assessments, WMII proposes to develop plans, if necessary, to perform remedial or corrective actions at the Site. Conceptually, these plans could involve the excavation, disposal, and backfilling of the excavations produced from the removal of the "tar like" materials and fencing the Site to provide a protected area for wildlife and to discourage trespassing.

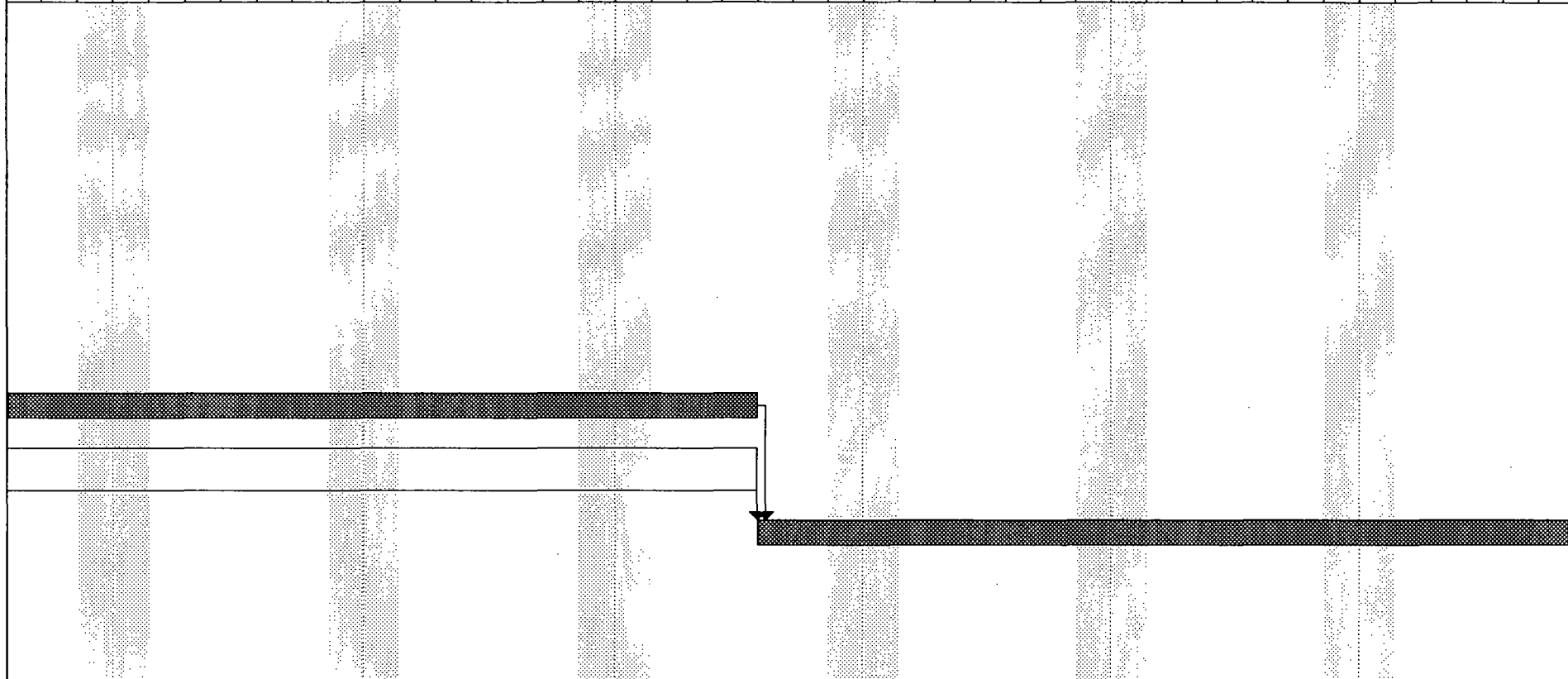
4.0 SCHEDULE








The attached schedule is proposed for completion of the proposed activities. This schedule will be adjusted, as required, with the concurrence of the IEPA.

ID	Task Name	Duration	Week 1							Week 2							Week 3							Week 4							Week 5				
			M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	
1	Agency Review of Workplan	20d																																	
2	Work Plan Approval	0d																																	
3	Prefield	10d																																	
4	Start Field Work	0d																																	
5	Well Integrity Survey	3d																																	
6	Write Well Plan	10d																																	
7	Agency Review Well Plan	10d																																	
8	Agency Approval of Well Plan	0d																																	
9	Well Installations/Abandonme	40d																																	
10	Groundwater Monitoring	260d																																	
11	Surface Soil Sampling	1d																																	
12	"Tar Like" Area Investigation	2d																																	
13	Risk Assessment	60d																																	
14	Write Rem/Corr Action Plan	60d																																	
15	Agency Review R/C Plan	20d																																	
16	Agency Approval Of R/C Plan	0d																																	

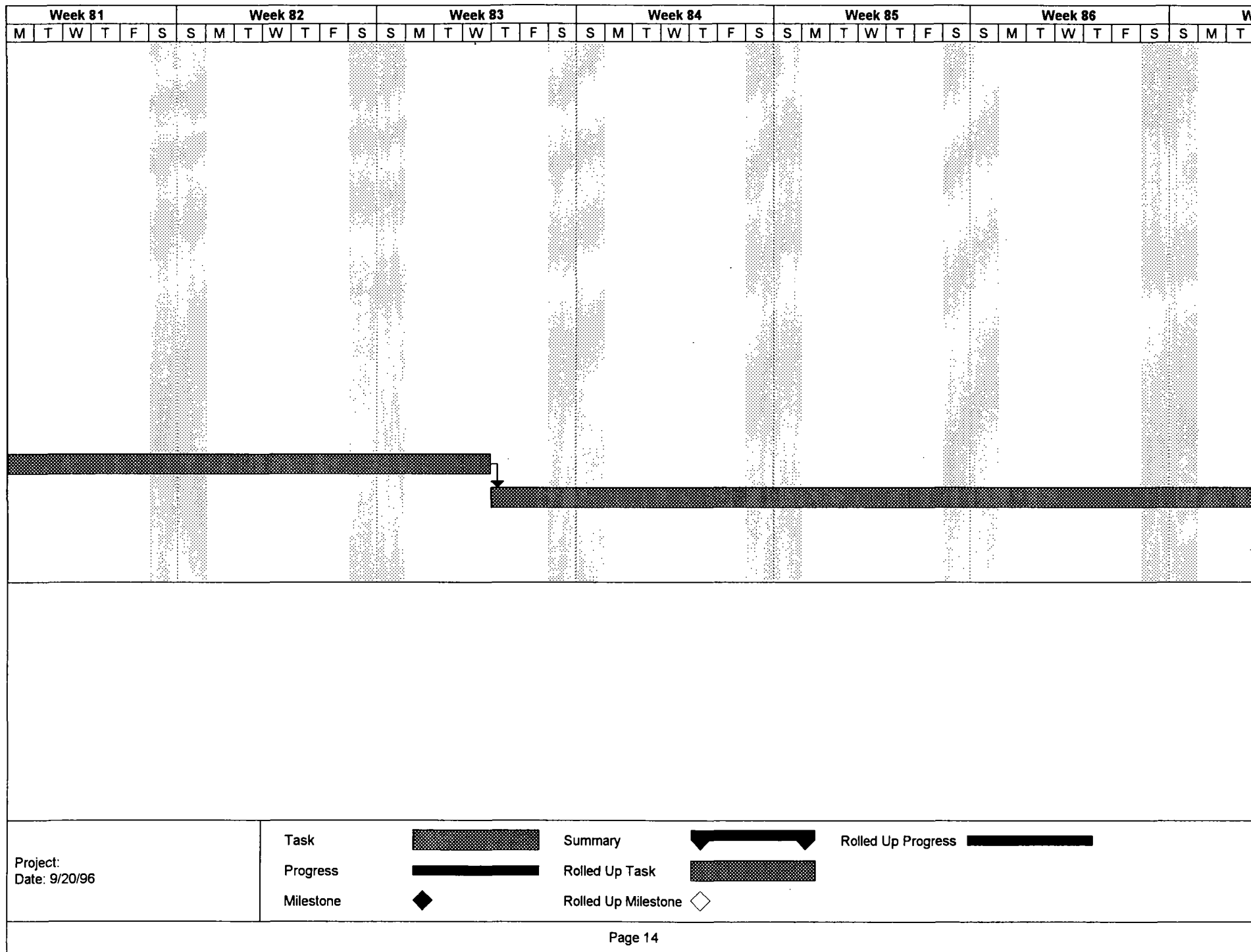
Week 12							Week 13							Week 14							Week 15							Week 16							Week 17								
S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M

8			Week 69							Week 70							Week 71							Week 72							Week 73							Week 74						
T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S							










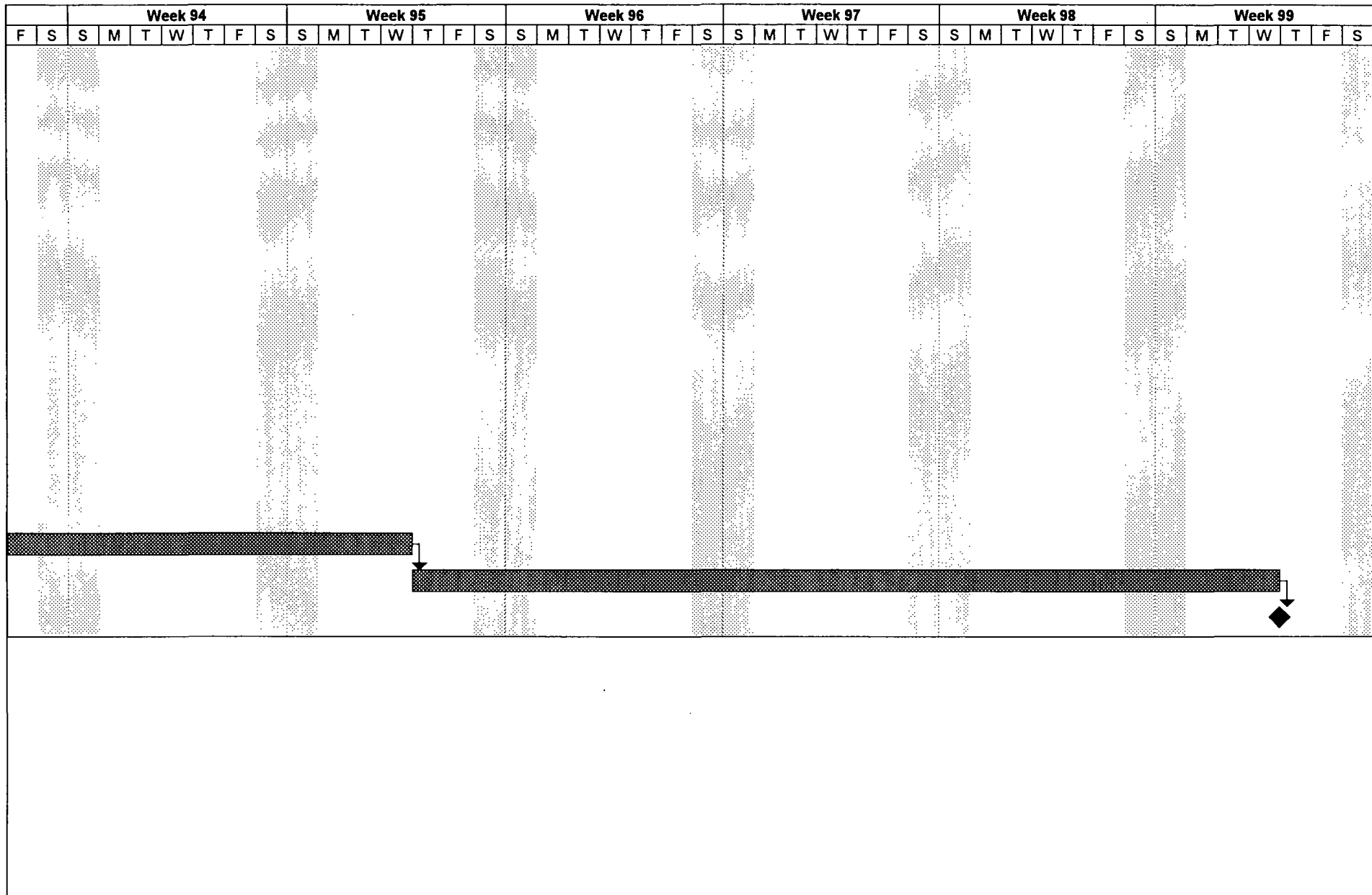
Project: Date: 9/20/96	Task		Summary		Rolled Up Progress	
	Progress		Rolled Up Task			
	Milestone		Rolled Up Milestone			

[illegible]



ek 87				Week 88							Week 89							Week 90							Week 91							Week 92							Week 93			
W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T	F	S	S	M	T	W	T						

Project: Date: 9/20/96	Task		Summary		Rolled Up Progress	
	Progress		Rolled Up Task			
	Milestone		Rolled Up Milestone			



Project: Date: 9/20/96	Task		Summary		Rolled Up Progress	
	Progress		Rolled Up Task			
	Milestone		Rolled Up Milestone			

5.0 REFERENCES

1. Canonie Engineers, June 1982, Hydrogeologic Investigation, Interlake Site. Prepared for Waste Management of Illinois, Inc.
2. Illinois Environmental Protection Agency, December 1989, CERCLA Screening Site Inspection Report.
3. Integrated Sites Inc., December 1991, Work Plan for the Property which is Bordered to the West by Stoney Island Avenue and to the South by 116th Street in Chicago, Illinois.
4. S. Cravens and A Zahn of the Illinois State Water Survey, September 1990, Ground-Water Quality Investigation and Monitoring Program Design for the Lake Calumet Area of Southeast Chicago.
5. Waste Management of Illinois, Inc., September 1994, Final Site Investigation Report and Some Additional Groundwater Classification Information, 0316000026 - Cook County, Chicago/Interlake Landfill Superfund/Technical Report.
6. Kenneth G. Duwal, University of Illinois, Chicago; Event-Based and Seasonal Precipitation Effects on Shallow Groundwater-Wetlands Interaction Near Lake Calumet, Southeast Chicago; Chicago, Illinois; 1989 (provided in Appendix E of this document).

TABLES

TABLE 1

SUMMARY OF WATER MONITORING WELL CONSTRUCTION DETAILS

Well No.	Well Depth (in feet from top of riser)	Well Materials	Depth to Bedrock/Refusal (in feet below MSL)	Date Well Constructed
ST-1D	115.5	2" PVC	486.2	3/3/82
ST-1S	10.5	4" PVC	NA	3/3/82
ST-2D	60.5	2" PVC	543.5	3/8/82
ST-2S	15.0	4" PVC	NA	3/9/82
ST-3D	101.5	2" PVC	500.3	4/13/82
ST-3S	12.0	4" PVC	NA	4/12/82
ST-4D	103.5	2" PVC	502.0	3/12/82
ST-4S	15.0	4" PVC	NA	3/12/82
SS-1D	111	4" SS	486.3	4/26/82
SS-2D	100	4" SS	501.3	5/3/82
B-8M	63.5	2" PVC	522.6	4/15/82
B-12M	68.0	2" PVC	500.9	4/9/82
B-13M	80.2	2" PVC	507.9	4/15/82
B-17M1	36.5	2" PVC	NA	4/1/82
B-17M2	89.0	2" PVC	495.1	4/23/82
B-17S	11.2	4" PVC	NA	4/23/82
B-19S	12.0	4" PVC	NA	4/16/82
B-22S	13.0	4" PVC	NA	4/20/82
B-23S	13.0	4" PVC	522.0	4/15/82
B-26S	15.0	4" PVC	NA	4/16/82
NOTES: NA - Bedrock was not encountered in this boring. MSL - Mean Sea Level				

TABLE 2
SUMMARY OF SAMPLING EVENTS

Sampling Point	Date Sampled	Sampled By	Analytical Parameters	Notes
ST-1D	5/7/82	Canonie	FP, WQ, PCB/Pest,VOC, BNA, Metals	
	7/19/89	USEPA	PCB/Pest, Metals, VOC, SVOC	USEPA Well G-101
ST-1S	5/4/82	Canonie	FP, WQ, PCB/Pest,VOC, BNA, Metals	
	7/12/91	WMII	WQ, SVOC, VOC	
ST-2D	5/5/82	Canonie	FP, WQ, PCB/Pest,VOC, BNA, Metals	
	7/19/89	USEPA	PCB/Pest, Metals, VOC, SVOC	USEPA Well G-102
ST-2S	5/5/82	Canonie	FP, WQ, PCB/Pest,VOC, BNA, Metals	
	7/12/91	WMII	WQ, SVOC, VOC	
ST-3D	5/11/82	Canonie	FP, WQ, PCB/Pest, VOC, Metals	Laboratory labeled this well SS-3D
	7/19/89	USEPA	PCB/Pest, Metals, VOC, SVOC	USEPA Well G-103
ST-3S	5/5/82	Canonie	FP, WQ, PCB/Pest,VOC, BNA, Metals	
	7/12/91	WMII	WQ, SVOC, VOC	
ST-4D	5/11/82	Canonie	FP, WQ, PCB/Pest, VOC, Metals	
	7/19/89	USEPA	PCB/Pest, Metals, VOC, SVOC	USEPA Well G-104
ST-4S	5/4/82	Canonie	FP, WQ, PCB/Pest,VOC, BNA, Metals	
	7/12/91	WMII	WQ, SVOC, VOC	

TABLE 2 (Continued)

SUMMARY OF SAMPLING EVENTS

Sampling Point	Date Sampled	Sampled By	Analytical Parameters	Notes
SS-1D	5/7/82	Canonie	FP, WQ, PCB/Pest, VOC, Metals	
	7/19/89	USEPA	PCB/Pest, Metals, VOC, SVOC	USEPA Well G-105
SS-2D	5/11/82	Canonie	FP, WQ, PCB/Pest, VOC, Metals	
	7/19/89	USEPA	PCB/Pest, Metals, VOC, SVOC	USEPA Well G-106
Background Well	5/11/82	Canonie	FP, WQ, PCB/Pest, VOC, Metals	Used water for well drilling
Background Well	7/18/89	USEPA	PCB/Pest, Metals, VOC, SVOC	USEPA Well G-107
<p>NOTES:</p> <ul style="list-style-type: none"> General groupings of parameters sampled for as provided by USEPA SW-846 <p>FP - Field parameters of temperature, pH, and conductivity WQ - Water quality parameters PCB/Pest - PCB and pesticides VOC - Volatile organic compounds SVOC - Semi volatile organic compounds (including Base, Metal, Acids (BNAs) Metals - Inorganic compounds</p>				

TABLE 3

**SUMMARY OF THE MOST RECENT GROUNDWATER SAMPLING RESULTS COMPARED
TO EXISTING IEPA STANDARDS¹
(IN UG/L, EXCEPT AS NOTED)**

Parameter	Well/Sampling Point Number											
	ST-1D 7/19/89	ST-1S 7/12/91	ST-2D 7/19/89	ST-2S 7/12/91	ST-3D 7/19/89	ST-3S 7/12/91	ST-4D 7/19/89	ST-4S 7/12/91	ST-6S 7/12/91	SS-1D 7/19/89	SS-2D 7/19/89	Back- ground 7/19/89
Acetone (700)	76J	230	3200	18	300	44	99	ND	210	880	11000	91
Total Xylenes (10)	ND	9J	ND	ND	ND	ND	ND	8J	13J	ND	ND	ND
pH (6.5-9.0 units)	8.4	NT	7.5	NT	8.3	NT	8.1	NT	NT	9.1	8.5	8.0
BEHP (6)	ND	ND	0.2	ND	1J	ND	ND	ND	ND	9J	ND	ND
Phenol (100)	ND	150	ND	ND	ND	ND	ND	ND	160	ND	ND	ND
<p>NOTES:</p> <p>¹ - Analytical results were compared to Part 859 Appendix A - IEPA Class I Groundwater Remedial Objectives. Remedial Objectives are shown in parentheses next to the parameter. Only compounds with detects above Remedial Objectives are listed.</p> <p>NT - Not Tested.</p> <p>ND - Not Detected or Below Method Detection Limit.</p> <p>J - Estimated value.</p> <p>BEHP - Bis(2-Ethylhexyl)Phthalate.</p> <p>µg/L - Micrograms per liter.</p>												

TABLE 4
SUMMARY OF SURFACE WATER SAMPLING RESULTS COMPARED
TO EXISTING IEPA STANDARDS ¹
(IN MG/L)

Parameter and Date Sampled	Sampling Point											
	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10	SW-11	SW-12
Ammonia (0.1) (Unionized)												
(7/90)	WRL	0.125	WRL	4.609	1.599	WRL	NT	NT	NT	NT	NT	NT
(8/90)	0.307	0.423	WRL	3.623	NT	WRL	WRL	0.879	0.424	0.129	NT	NT
(12/90)	0.197	NT	WRL	NT	NT	WRL	NT	2.027	0.240	WRL	0.242	0.164
(3/91)	0.449	0.497	WRL	NT	NT	WRL	NT	2.562	0.943	0.397	0.406	0.173
(4/91)	0.233	0.670	WRL	NT	NT	WRL	NT	1.044	0.680	0.338	0.144	0.140
(5/91)	0.317	0.231	WRL	NT	NT	WRL	NT	0.942	0.322	0.250	2.870	0.333
Boron (1.0)												
(7/90)	1.4	1.4	WRL	2.7	2.3	WRL	NT	NT	NT	NT	NT	NT
(8/90)	1.2	1.3	WRL	2.0	NT	WRL	WRL	WRL	1.1	1.2	NT	NT
(10/90)	1.3	1.2	WRL	3.6	NT	WRL	WRL	WRL	1.2	1.3	NT	NT
(12/90)	WRL	NT	WRL	NT	NT	WRL	NT	WRL	WRL	WRL	1.1	WRL
(3/91)	WRL	WRL	WRL	NT	NT	WRL	NT	WRL	WRL	WRL	1.0	WRL
(4/91)	1.0	1.0	WRL	NT	NT	WRL	NT	WRL	1.0	1.0	WRL	WRL
(5/91)	WRL	WRL	WRL	NT	NT	WRL	NT	WRL	WRL	WRL	1.5	WRL
Chromium VI (0.3)												
(8/90)	WRL	WRL	WRL	WRL	NT	0.710	WRL	WRL	WRL	WRL	NT	NT
Cyanide (0.1)												
(12/90)	WRL	NT	WRL	NT	NT	WRL	NT	WRL	WRL	WRL	WRL	3.0
(5/91)	WRL	WRL	WRL	NT	NT	WRL	NT	WRL	WRL	WRL	WRL	0.1
(8/93)	NT	NT	NT	WRL	NT	NT	NT	NT	NT	NT	NT	0.2*

TABLE 4 (Continued)

SUMMARY OF SURFACE WATER SAMPLING RESULTS COMPARED
TO EXISTING IEPA STANDARDS ¹
(IN MG/L)

Parameter and Date Sampled	Sampling Point											
	SW-1	SW-2	SW-3	SW-4	SW-5	SW-6	SW-7	SW-8	SW-9	SW-10	SW-11	SW-12
Iron (0.5) (dissolved)												
(7/90)	WRL	WRL	WRL	1.1	0.60	WRL	NT	NT	NT	NT	NT	NT
(8/90)	WRL	WRL	WRL	0.74	NT	WRL	WRL	WRL	WRL	WRL	NT	NT
(10/90)	WRL	WRL	WRL	0.93	NT	WRL	WRL	WRL	WRL	WRL	NT	NT
(5/91)	WRL	WRL	WRL	NT	NT	WRL	NT	WRL	WRL	WRL	WRL	WRL
Iron (2.0) (total)												
(8/90)	2.3	WRL	WRL	WRL	NT	WRL	WRL	WRL	WRL	2.2	NT	NT
(10/90)	WRL	WRL	WRL	WRL	NT	WRL	WRL	WRL	WRL	3.6	NT	NT
(12/90)	WRL	NT	WRL	NT	NT	WRL	NT	WRL	WRL	2.2	WRL	4.4
(3/91)	WRL	WRL	WRL	NT	NT	WRL	NT	WRL	WRL	WRL	2.1	2.6
(5/91)	WRL	WRL	WRL	NT	NT	WRL	NT	WRL	WRL	WRL	2.0	WRL
Lead (1.0)												
(4/91)	1.3	WRL	WRL	NT	NT	WRL	NT	WRL	WRL	WRL	WRL	WRL
Mercury (0.0005)												
(12/90)	WRL	NT	WRL	NT	NT	WRL	NT	WRL	WRL	WRL	WRL	0.00058
pH (6.0 - 9.0 pH Units)												
(8/90)	WRL	WRL	WRL	WRL	NT	WRL	WRL	10.4	9.17	WRL	NT	NT
(10/90)	WRL	WRL	WRL	WRL	NT	WRL	WRL	9.16	WRL	WRL	NT	NT
(12/90)	WRL	NT	WRL	NT	NT	WRL	NT	9.89	WRL	WRL	WRL	WRL
(3/91)	WRL	WRL	WRL	NT	NT	WRL	NT	11.68	WRL	WRL	WRL	WRL
(4/91)	WRL	WRL	WRL	NT	NT	WRL	NT	10.01	WRL	WRL	WRL	WRL
(5/91)	WRL	WRL	WRL	NT	NT	WRL	NT	10.61	WRL	WRL	WRL	WRL
NOTES: ¹ - Analytical results were compared to Part 302 Water Quality Standard, Subpart D - Secondary Contact and Indigenous Aquatic Life Standards. Regulatory standards are shown in parentheses next to the parameter. WRL - Within Regulatory Limits. * - Reactive cyanide measurement could not be correlated to total cyanide measurement. mg/L - Milligrams per liter. NT - Not Tested.												

TABLE 5

SUMMARY OF MOST RECENT SOIL AND SEDIMENT SAMPLING RESULTS
COMPARED TO EXISTING IEPA STANDARDS¹
(IN MG/KG)

Parameter	Sampling Location and Date Sampled											
	X-101 (7/89)	X-102 (7/89)	X-103 (7/89)	X-104 (7/89)	X-105 (7/89)	X-106 (7/89)	X-107 (7/89)	X-108 (7/89)	SW-4 (3/94)	SW-12 (3/94)	SW-4 (7/94)	SW-12 (7/94)
Benzo(a)anthracene (0.7)	WRL	WRL	4.5	WRL	2.8	WRL	WRL	WRL	WRL	WRL	WRL	WRL
Chrysene (1)	WRL	WRL	4.5	WRL	2.8	WRL	WRL	WRL	WRL	WRL	WRL	WRL
Benzofluoranthene (4)	WRL	WRL	7.4	WRL	5.0	WRL	WRL	WRL	WRL	WRL	WRL	WRL
Gamma BHC-Lindane (0.006)	WRL	0.0098	WRL	WRL	WRL	WRL	WRL	WRL	WRL	WRL	WRL	WRL
Arsenic (0.05*)	4.8	7.6	5.1	4.6	3.0	2.7	2.9	4.9	WRL	WRL	WRL	WRL
Barium (2*)	520	144	83	75	220	75	50	122	WRL	WRL	WRL	WRL
Beryllium (0.006*)	7.3	0.4	0.9	0.5	1.6	0.4	WRL	0.5	WRL	WRL	WRL	WRL
Chromium (0.1*)	0.7	0.7	1.9	1.0	18	0.7	WRL	1.1	WRL	WRL	WRL	WRL
Mercury (0.002*)	WRL	WRL	0.2	0.1	0.2	0.3	WRL	0.1	WRL	WRL	WRL	WRL
Nickel (0.1*)	11	11	17	14	9	9.6	11	31	WRL	WRL	WRL	WRL
Lead (0.0075*)	20	76	128	69	110	40	WRL	132	WRL	WRL	WRL	WRL
Selenium (0.05*)	4.6	WRL	WRL	WRL	WRL	WRL	WRL	WRL	WRL	WRL	WRL	WRL
Zinc (5*)	140	200	156	160	160	77	41	85	WRL	WRL	WRL	WRL
Cyanide (0.2*)	1.6	WRL	WRL	WRL	0.7	WRL	4.2	WRL	1.91	1.94	3.37	2.81

NOTES:

¹ - Analytical results were compared to Part 859 Appendix A - Class I Soil Remedial Objectives. Remedial Objectives are shown in parentheses next to the parameter. Analytical results are not TCLP results, but total results. These results are from the CERCLA Screening Site Inspection Report, IEPA, Undated.

* - These regulatory limits are TCLP limits in mg/l.

mg/Kg - Milligrams per kilogram.

WRL - Within Regulatory Limit.

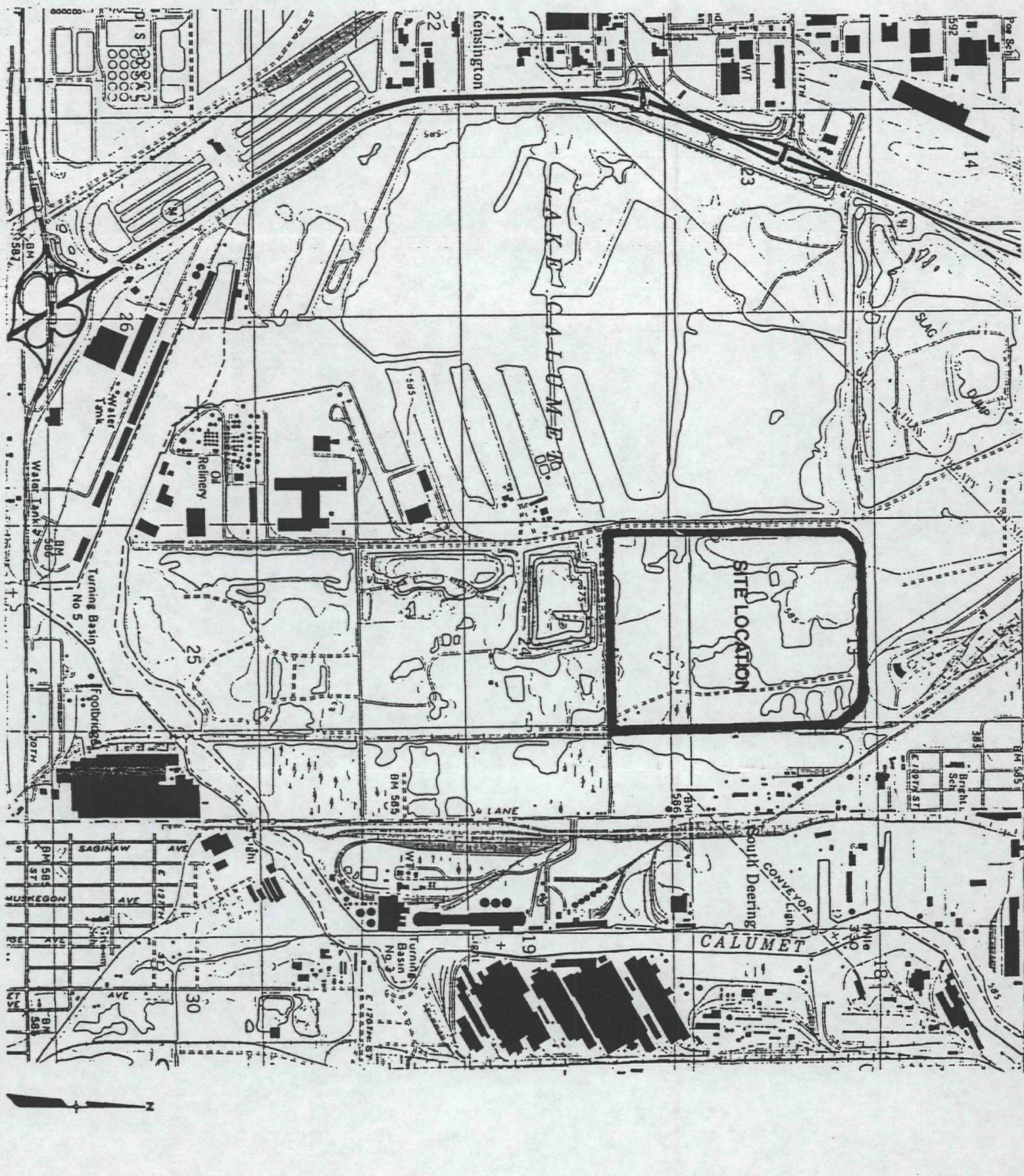
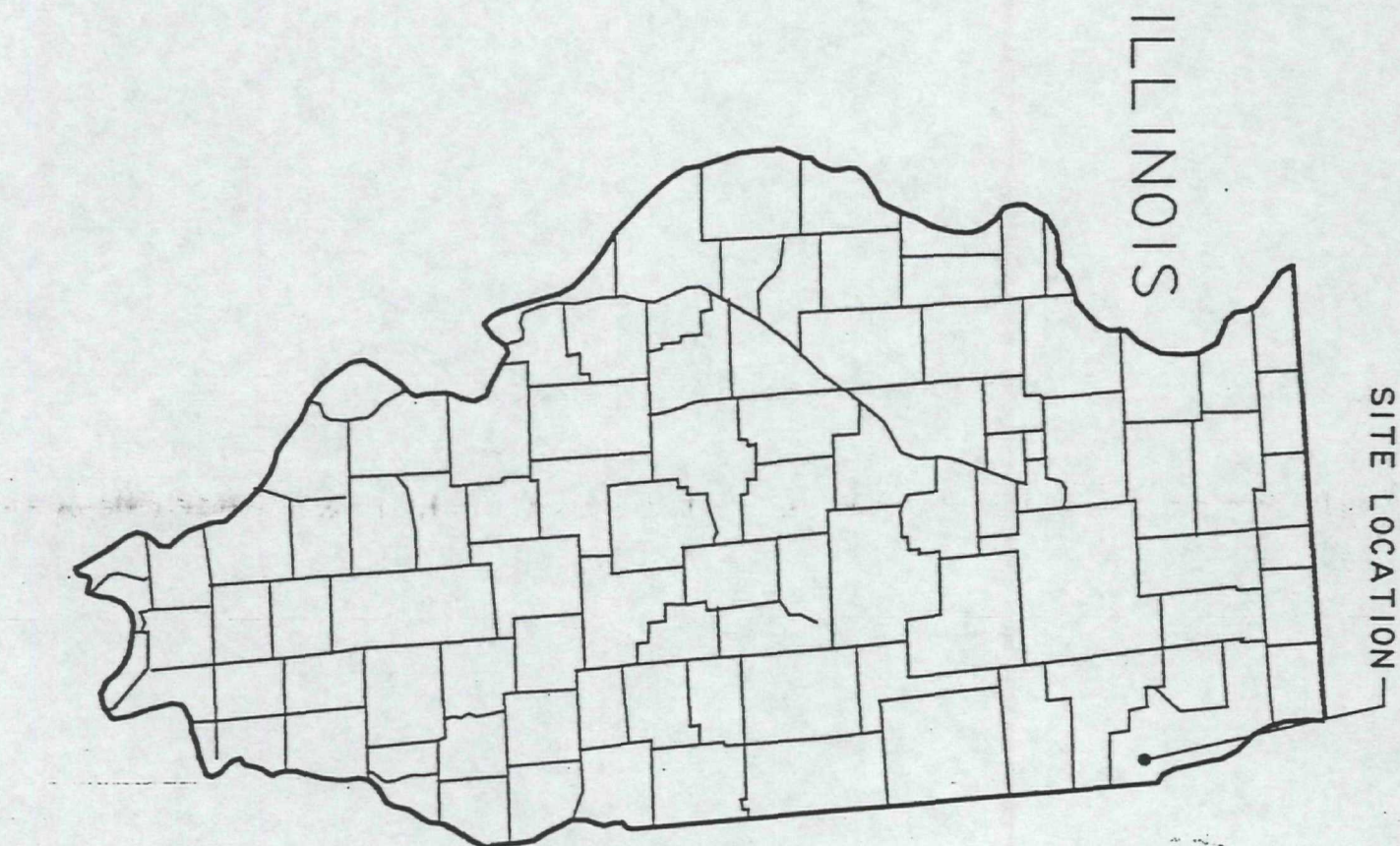
TABLE 6

**MONITORING WELLS AND PARAMETERS PROPOSED FOR
SUPPLEMENTAL GROUNDWATER MONITORING**

Monitoring Well No.	Parameter	Sample Frequency
ST-1S	IEPA TCL	Bi-annual for 1 year
ST-1D	IEPA TCL	Bi-annual for 1 year
B-19S	IEPA TCL	Bi-annual for 1 year
B-17S	IEPA TCL	Bi-annual for 1 year
B-26S	IEPA TCL	Bi-annual for 1 year
ST-4S	IEPA TCL	Bi-annual for 1 year
ST-4D	IEPA TCL	Bi-annual for 1 year
New Well	IEPA TCL	Bi-annual for 1 year

FIGURES

FIGURE 1
LOCATION MAP



RUST ENVIRONMENT &
INFRASTRUCTURE
Minneapolis, MN 55441

FIGURE 1
LOCATION MAP
PRE-NOTICE SITE CLEAN-UP
INTERLAKE SITE
CHICAGO, ILLINOIS

FIGURE 2
PREVIOUS SAMPLING LOCATIONS

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Waste MGMT INC – Map Previous Sampling Locations

Document is available at the EPA Region 5 Records Center.

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FIGURE 3

PIEZOMETRIC SURFACE OF THE BEDROCK AQUIFER

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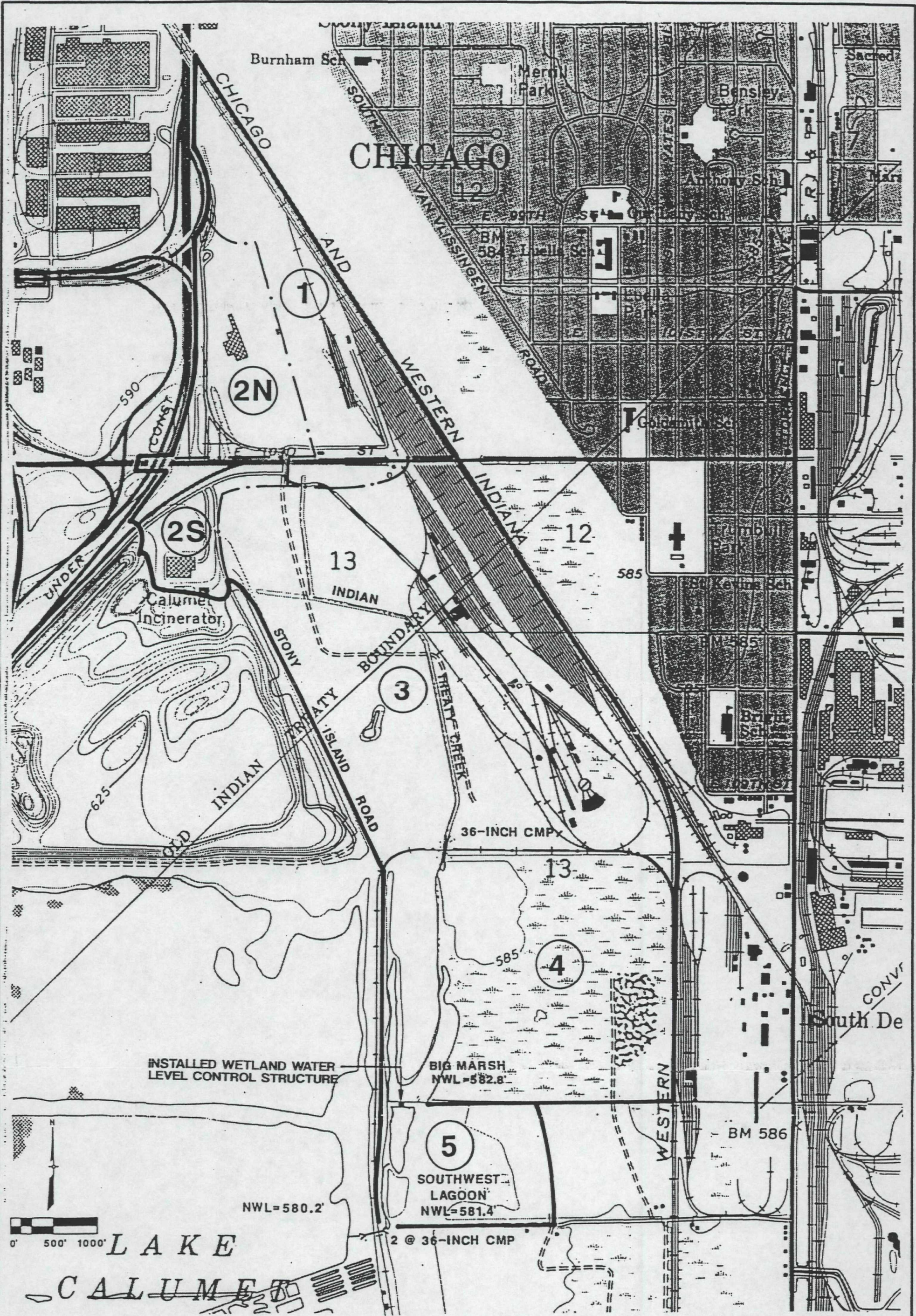
Waste MGMT INC – Map Piezometric Surface of the Bedrock Aquifer

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FIGURE 5

WATERSHED DELINEATION MAP



APPENDICES

APPENDIX A

GROUNDWATER SAMPLING ANALYTICAL RESULTS

WELL MONITORING ANALYSIS REPORT

WELL ST-15

ENVIRONMENTAL LAB #: 745

SITE: CWM (Interlake)

WELL POINT #: C-627

DATE SAMPLED: 5-4-82

LAB MANAGER: John W. Kelpner
6-16-82

Test	Results	Date Complete	Test	Results	C
Depth, m			Hardness, as CaCO ₃ , mg/l		
Stick-up, m			Nitrate, as N, mg/l	✓ 0.36	
Temperature, °C			Nitrogen, Ammonia, as N, mg/l	✓ 5.60	
			Sulfate, as SO ₄ , mg/l	✓ 8.95	
			Phosphate as PO ₄ , mg/l	✓ <0.01	
pH, units			Cyanide, as CN, mg/l	✓ 0.19	
Conductivity, mS			Oil and Grease, mg/l		
Thallium, as Tl, mg/l	✓		Phenol, mg/l	✓ 0.067	
Molybdenum, as Mo, mg/l	✓				
Arsenic, as As, mg/l	✓ <0.005				
Barium, as Ba, mg/l	✓ 0.088		Total Dissolved Solids, mg/l @ 180° C		
Boron, as B, mg/l	✓ <0.004		Total Suspended Solids, mg/l @ 105° C		
Cadmium, as Cd, mg/l	✓ 0.003		Residue on Evaporation @ 180° C		
Calcium, as Ca, mg/l	✓ 100.		Cobalt, as Co, mg/l	✓ 0.009	
Chromium, Total as Cr, mg/l	✓ 0.034		Vanadium, as V, mg/l	✓ 0.019	
Hexavalent Chromium, as Cr, mg/l	✓ <0.01		Radium		
Copper, as Cu, mg/l	✓ 0.009		Gross Alpha		
Iron, total as Fe, mg/l	✓ 0.011		Gross Beta		
Iron, dissolved as Fe, mg/l	✓ <0.005				
Lead, as Pb, mg/l	✓ <0.005				
Manganese, as Mn, mg/l	✓ 0.003		Total Organic Carbon, mg/l		
Magnesium, as Mg, mg/l	✓ 0.410		Total Organic Halogen, mg/l		
Mercury, as Hg, mg/l	✓ 0.0002				
Nickel, as Ni, mg/l	✓ <0.01		Endrin, mg/l		
Potassium, as K, mg/l	✓ 258.		Lindane, mg/l		
Selenium, as Se, mg/l	✓ <0.005		Methoxychlor, mg/l		
Silver, as Ag, mg/l	✓ 0.019		2, 4D, mg/l		
Sodium, as Na, mg/l	✓ 76.3		2, 4, 5 TP (Silvex) mg/l		
Zinc, as Zn, mg/l	✓ <0.004				
Beryllium, as Be, mg/l	✓ <0.001				
Antimony, as Sb, mg/l	✓ 0.034				
Alkalinity, as CaCO ₃ , mg/l			Fecal Coliform		
Chloride, as Cl, mg/l	✓ 99.1				
COD mg/l	✓ 83.2		Priority Pollutants	✓	
Fluorides, as F, mg/l	✓ 1.7		Scan		

PHYSICAL APPEARANCE: _____

SAMPLE IDENTIFICATION: Interlake #1

TECHNICAL CENTER SAMPLE NUMBER: ENV 745

VOLATILE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	ACROLEIN	BDL	100
2V.	ACRYLONITRILE	BDL	100
3V.	BENZENE	910	10
4V.	BIS (CHLOROMETHYL) ETHER	BDL	10
5V.	BROMOFORM	BDL	10
6V.	CARBON TETRACHLORIDE	BDL	10
7V.	CHLOROBENZENE	BDL	10
8V.	CHLORODIBROMOMETHANE	BDL	10
9V.	CHLOROETHANE	BDL	10
10V.	2-CHLOROETHYL VINYL ETHER	BDL	10
11V.	CHLOROFORM	BDL	10
12V.	DICHLOROBROMOMETHANE	BDL	10
13V.	DICHLORODIFLUOROMETHANE	BDL	10
14V.	1,1-DICHLOROETHANE	BDL	10
15V.	1,2-DICHLOROETHANE	BDL	10
16V.	1,1-DICHLOROETHYLENE	BDL	10
17V.	1,2-DICHLOROPROPANE	BDL	10
18V.	1,3-DICHLOROPROPYLENE	BDL	10
19V.	ETHYLBENZENE	BDL	10
20V.	METHYL BROMIDE	BDL	10
21V.	METHYL CHLORIDE	BDL	10
22V.	METHYLENE CHLORIDE	BDL	10
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	10
24V.	TETRACHLOROETHYLENE	BDL	10
25V.	TOLUENE	BDL	10
26V.	1,2-TRANS-DICHLOROETHYLENE	BDL	10
27V.	1,1,1-TRICHLOROETHANE	BDL	10
28V.	1,1,2-TRICHLOROETHANE	BDL	10
29V.	TRICHLOROETHYLENE	BDL	10
30V.	TRICHLOROFLUOROMETHANE	BDL	10
31V.	VINYL CHLORIDE	BDL	10

BDL=BELOW DETECTION LIMIT

SAMPLE IDENTIFICATION: Interlake #1

TECHNICAL CENTER SAMPLE NUMBER: ENV 745

BASE-NEUTRAL EXTRACTABLE ORGANICS	CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1B. ACENAPHTHENE	BDL	10
2B. ACENAPHTHYLENE	BDL	10
3B. ANTHRACENE	BDL	10
4B. BENZIDINE	BDL	10
5B. BENZO (A) ANTHRACENE	BDL	10
6B. BENZO (A) PYRENE	BDL	10
7B. 3,4-BENZOFLUORANTHENE	BDL	10
8B. BENZO (GHI) PERYLENE	BDL	25
9B. BENZO (K) FLUORANTHENE	BDL	10
10B. BIS (2-CHLOROETHOXY) METHANE	BDL	10
11B. BIS (2-CHLOROETHYL) ETHER	BDL	10
12B. BIS (2-CHLOROISOPROPYL) ETHER	BDL	10
13B. BIS (2-ETHYLHEXYL) PHTHALATE	BDL	10
14B. 4-BROMOPHENYL PHENYL ETHER	BDL	10
15B. BUTYL BENZYL PHTHALATE	BDL	10
16B. 2-CHLORONAPHTHALENE	BDL	10
17B. 4-CHLOROPHENYL PHENYL ETHER	BDL	10
18B. CHRYSENE	BDL	10
19B. DIBENZO (A,H) ANTHRACENE	BDL	25
20B. 1,2-DICHLOROBENZENE	BDL	10
21B. 1,3-DICHLOROBENZENE	BDL	10
22B. 1,4-DICHLOROBENZENE	BDL	10
23B. 3,3'-DICHLOROBENZIDINE	BDL	10
24B. DIETHYL PHTHALATE	BDL	10
25B. DIMETHYL PHTHALATE	BDL	10
26B. DI-N-BUTYL PHTHALATE	BDL	10
27B. 2,4-DINITROTOLUENE	BDL	10
28B. 2,6-DINITROTOLUENE	BDL	10
29B. DI-N-OCTYL PHTHALATE	BDL	10
30B. 1,2-DIPHENYLHYDRAZINE	BDL	10
31B. FLUORANTHENE	BDL	10

BDL-BELOW DETECTION LIMIT

WELL MONITORING ANALYSIS REPORT

WELL ST-25

ENVIRONMENTAL LAB #: 766

SITE: Cwm (Interlake)

WELL POINT #: C-630

DATE SAMPLED: 5-5-82

LAB MANAGER: John W. Kellogg
6-16-82

Test	Results	Date Complete	Test	Results
Depth, m			Hardness, as CaCO ₃ , mg/l	
Stick-up, m			Nitrate, as N, mg/l	✓ 40.05
Temperature, °C			Nitrogen, Ammonia, as N, mg/l	✓ 1.94
			Sulfate, as SO ₄ , mg/l	✓ 44.6
			Phosphate, as P, mg/l	✓ 40.01
pH, units			Cyanide, as CN, mg/l	✓ 1.29
Conductivity, mS			Oil and Grease, mg/l	
Thallium, as Tl, mg/l	✓		Phenol, mg/l	✓ 40.010
Molybdenum, as Mo, mg/l	✓			
Arsenic, as As, mg/l	✓ 40.005			
Barium, as Ba, mg/l	✓ 0.070		Total Dissolved Solids, mg/l @ 180° C	
Boron, as B, mg/l	✓ 0.183		Total Suspended Solids, mg/l @ 105° C	
Cadmium, as Cd, mg/l	✓ 0.053		Residue on Evaporation @ 180° C	
Calcium, as Ca, mg/l	✓ 139.		Cobalt, as Co, mg/l	✓ 0.245
Chromium, Total as Cr, mg/l	✓ 0.319		Vanadium, as V, mg/l	✓ 0.325
Hexavalent Chromium, as Cr, mg/l	✓ 40.01		Radium	
Copper, as Cu, mg/l	✓ 0.133		Gross Alpha	
Iron, total as Fe, mg/l	✓ 0.434		Gross Beta	
Iron, dissolved as Fe, mg/l	✓ 40.005			
Lead, as Pb, mg/l	✓ 40.005			
Manganese, as Mn, mg/l	✓ 0.823		Total Organic Carbon, mg/l	
Magnesium, as Mg, mg/l	✓ 28.8		Total Organic Halogen, mg/l	
Mercury, as Hg, mg/l	✓ 0.0006			
Nickel, as Ni, mg/l	✓ 0.250			
Potassium, as K, mg/l	✓ 2110.		Endrin, mg/l	
Selenium, as Se, mg/l	✓ 40.005		Lindane, mg/l	
Silver, as Ag, mg/l	✓ 0.189		Methoxychlor, mg/l	
Sodium, as Na, mg/l	✓ 170.		2, 4D, mg/l	
Zinc, as Zn, mg/l	✓ 0.051		2, 4, 5 TP (Silvex) mg/l	
Antimony, as Sb, mg/l	✓ 0.838			
Beryllium, as Be, mg/l	✓ 0.011			
Alkalinity, as CaCO ₃ , mg/l			Fecal Coliform	
Chloride, as Cl, mg/l	✓ 179.			
COD mg/l	✓ 458.		Priority Pollutants Scan	✓
Fluorides, as F, mg/l	✓ 1.4			

PHYSICAL APPEARANCE: _____

SAMPLE IDENTIFICATION: Interlake #4

TECHNICAL CENTER SAMPLE NUMBER: ENV 766

VOLATILE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	ACROLEIN	BDL	100
2V.	ACRYLONITRILE	BDL	100
3V.	BENZENE	540	10
4V.	BIS (CHLOROMETHYL) ETHER	BDL	10
5V.	BROMOFORM	BDL	10
6V.	CARBON TETRACHLORIDE	BDL	10
7V.	CHLOROBENZENE	BDL	10
8V.	CHLORODIBROMOMETHANE	BDL	10
9V.	CHLOROETHANE	BDL	10
10V.	2-CHLOROETHYL VINYL ETHER	BDL	10
11V.	CHLOROFORM	BDL	10
12V.	DICHLOROBROMOMETHANE	BDL	10
13V.	DICHLORODIFLUOROMETHANE	BDL	10
14V.	1,1-DICHLOROETHANE	BDL	10
15V.	1,2-DICHLOROETHANE	BDL	10
16V.	1,1-DICHLOROETHYLENE	BDL	10
17V.	1,2-DICHLOROPROPANE	BDL	10
18V.	1,3-DICHLOROPROPYLENE	BDL	10
19V.	ETHYLBENZENE	BDL	10
20V.	METHYL BROMIDE	BDL	10
21V.	METHYL CHLORIDE	BDL	10
22V.	METHYLENE CHLORIDE	BDL	10
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	10
24V.	TETRACHLOROETHYLENE	BDL	10
25V.	TOLUENE	BDL	10
26V.	1,2-TRANS-DICHLOROETHYLENE	BDL	10
27V.	1,1,1-TRICHLOROETHANE	BDL	10
28V.	1,1,2-TRICHLOROETHANE	BDL	10
29V.	TRICHLOROETHYLENE	BDL	10
30V.	TRICHLOROFLUOROMETHANE	BDL	10
31V.	VINYL CHLORIDE	BDL	10

BDL=BELOW DETECTION LIMIT

SAMPLE IDENTIFICATION: Interlake #4

TECHNICAL CENTER SAMPLE NUMBER: ENV 766

BASE-NEUTRAL EXTRACTABLE ORGANICS	CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1B. ACENAPHTHENE	BDL	10
2B. ACENAPHTHYLENE	BDL	10
3B. ANTHRACENE	BDL	10
4B. BENZIDINE	BDL	10
5B. BENZO (A) ANTHRACENE	BDL	10
6B. BENZO (A) PYRENE	BDL	10
7B. 3,4-BENZOFUORANTHENE	BDL	10
8B. BENZO (GHI) PERYLENE	BDL	25
9B. BENZO (K) FLUORANTHENE	BDL	10
0B. BIS (2-CHLOROETHOXY) METHANE	BDL	10
1B. BIS (2-CHLOROETHYL) ETHER	BDL	10
2B. BIS (2-CHLOROISOPROPYL) ETHER	BDL	10
3B. BIS (2-ETHYLHEXYL) PHTHALATE	BDL	10
4B. 4-BROMOPHENYL PHENYL ETHER	BDL	10
5B. BUTYL BENZYL PHTHALATE	BDL	10
6B. 2-CHLORONAPHTHALENE	BDL	10
7B. 4-CHLOROPHENYL PHENYL ETHER	BDL	10
8B. CHRYSENE	BDL	10
9B. DIBENZO (A,H) ANTHRACENE	BDL	25
0B. 1,2-DICHLOROBENZENE	BDL	10
1B. 1,3-DICHLOROBENZENE	BDL	10
2B. 1,4-DICHLOROBENZENE	BDL	10
3B. 3,3'-DICHLOROBENZIDINE	BDL	10
4B. DIETHYL PHTHALATE	BDL	10
5B. DIMETHYL PHTHALATE	BDL	10
5B. DI-N-BUTYL PHTHALATE	BDL	10
7B. 2,4-DINITROTOLUENE	BDL	10
3B. 2,6-DINITROTOLUENE	BDL	10
3B. DI-N-OCTYL PHTHALATE	BDL	10
0B. 1,2-DIPHENYLHYDRAZINE	BDL	10
1B. FLUORANTHENE	BDL	10

BDL-BELOW DETECTION LIMIT

WELL MONITORING ANALYSIS REPORT

WELL ST-35

ENVIRONMENTAL LAB #: 767

SITE: CWM (Interlake)

WELL POINT #: C-631

DATE SAMPLED: 5-5-82

LAB MANAGER: John W. Kellogg
6-16-82

Test	Results	Date Complete	Test	Results
Depth, m			Hardness, as CaCO ₃ , mg/l	
Stick-up, m			Nitrate, as N, mg/l	✓ 1.87
Temperature, °C			Nitrogen, Ammonia, as N, mg/l	✓ 94.
			Sulfate, as SO ₄ , mg/l	✓ 139.
			Phosphate, as PO ₄ , mg/l	✓ 0.03
pH, units			Cyanide, as CN, mg/l	✓ 3.67
Conductivity, mS			Oil and Grease, mg/l	
Thallium, as Tl, mg/l	✓		Phenol, mg/l	✓ 0.044
Molybdenum, as Mo, mg/l	✓			
Arsenic, as As, mg/l	✓	40.005		
Barium, as Ba, mg/l	✓	0.064	Total Dissolved Solids, mg/l @ 180° C	
Boron, as B, mg/l	✓	3.15	Total Suspended Solids, mg/l @ 105° C	
Cadmium, as Cd, mg/l	✓	0.056	Residue on Evaporation @ 180° C	
Calcium, as Ca, mg/l	✓	28.8	Cobalt, as Co, mg/l	✓ 0.262
Chromium, Total as Cr, mg/l	✓	0.403	Vanadium, as V, mg/l	✓ 0.257
Hexavalent Chromium, as Cr, mg/l	✓	0.40	Radium	
Copper, as Cu, mg/l	✓	0.142	Gross Alpha	
Iron, total as Fe, mg/l	✓	4.20	Gross Beta	
Iron, dissolved as Fe, mg/l	✓	0.553		
Lead, as Pb, mg/l	✓	0.010		
Manganese, as Mn, mg/l	✓	0.196	Total Organic Carbon, mg/l	
Magnesium, as Mg, mg/l	✓	8.06	Total Organic Halogen, mg/l	
Mercury, as Hg, mg/l	✓	40.0001		
Nickel, as Ni, mg/l	✓	0.277		
Potassium, as K, mg/l	✓	2180.	Endrin, mg/l	
Selenium, as Se, mg/l	✓	40.005	Lindane, mg/l	
Silver, as Ag, mg/l	✓	0.192	Methoxychlor, mg/l	
Sodium, as Na, mg/l	✓	399.	2, 4D, mg/l	
Zinc, as Zn, mg/l	✓	0.096	2, 4, 5 TP (Silvex) mg/l	
Antimony, as Sb, mg/l	✓	0.840		
Beryllium, as Be, mg/l	✓	0.013		
Alkalinity, as CaCO ₃ , mg/l			Fecal Coliform	
Chloride, as Cl, mg/l	✓	795.		
COD mg/l	✓	1250.	Priority Pollutant Scan	✓
Fluorides, as F, mg/l	✓	1.9		

PHYSICAL APPEARANCE: _____

SAMPLE IDENTIFICATION: Interlake #5

TECHNICAL CENTER SAMPLE NUMBER: ENV 767

VOLATILE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	ACROLEIN	BDL	100
2V.	ACRYLONITRILE	BDL	100
3V.	BENZENE	410	10
4V.	BIS (CHLOROMETHYL) ETHER	BDL	10
5V.	BROMOFORM	BDL	10
6V.	CARBON TETRACHLORIDE	BDL	10
7V.	CHLOROBENZENE	BDL	10
8V.	CHLORODIBROMOMETHANE	BDL	10
9V.	CHLOROETHANE	BDL	10
10V.	2-CHLOROETHYL VINYL ETHER	BDL	10
11V.	CHLOROFORM	BDL	10
12V.	DICHLOROBROMOMETHANE	BDL	10
13V.	DICHLORODIFLUOROMETHANE	BDL	10
14V.	1,1-DICHLOROETHANE	BDL	10
15V.	1,2-DICHLOROETHANE	BDL	10
16V.	1,1-DICHLOROETHYLENE	BDL	10
17V.	1,2-DICHLOROPROPANE	BDL	10
18V.	1,3-DICHLOROPROPYLENE	BDL	10
19V.	ETHYLBENZENE	BDL	10
20V.	METHYL BROMIDE	BDL	10
21V.	METHYL CHLORIDE	BDL	10
22V.	METHYLENE CHLORIDE	BDL	10
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	10
24V.	TETRACHLOROETHYLENE	BDL	10
25V.	TOLUENE	BDL	10
26V.	1,2-TRANS-DICHLOROETHYLENE	BDL	10
27V.	1,1,1-TRICHLOROETHANE	BDL	10
28V.	1,1,2-TRICHLOROETHANE	BDL	10
29V.	TRICHLOROETHYLENE	BDL	10
30V.	TRICHLOROFLUOROMETHANE	BDL	10
31V.	VINYL CHLORIDE	BDL	10

BDL=BELOW DETECTION LIMIT

SAMPLE IDENTIFICATION: Interlake #5

TECHNICAL CENTER SAMPLE NUMBER: ENV 767

BASE-NEUTRAL EXTRACTABLE ORGANICS	CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1B. ACENAPHTHENE	BDL	10
2B. ACENAPHTHYLENE	BDL	10
3B. ANTHRACENE	BDL	10
4B. BENZIDINE	BDL	10
5B. BENZO (A) ANTHRACENE	BDL	10
6B. BENZO (A) PYRENE	BDL	10
7B. 3,4-BENZOFUORANTHENE	BDL	10
8B. BENZO (GHI) PERYLENE	BDL	25
9B. BENZO (K) FLUDRANTHENE	BDL	10
0B. BIS (2-CHLOROETHOXY) METHANE	BDL	10
1B. BIS (2-CHLOROETHYL) ETHER	BDL	10
2B. BIS (2-CHLOROISOPROPYL) ETHER	BDL	10
3B. BIS (2-ETHYLHEXYL) PHTHALATE	BDL	10
4B. 4-BROMOPHENYL PHENYL ETHER	BDL	10
5B. BUTYL BENZYL PHTHALATE	BDL	10
6B. 2-CHLORONAPHTHALENE	BDL	10
7B. 4-CHLOROPHENYL PHENYL ETHER	BDL	10
8B. CHRYSENE	BDL	10
9B. DIBENZO (A,H) ANTHRACENE	BDL	25
0B. 1,2-DICHLOROBENZENE	BDL	10
1B. 1,3-DICHLOROBENZENE	BDL	10
2B. 1,4-DICHLOROBENZENE	BDL	10
3B. 3,3'-DICHLOROBENZIDINE	BDL	10
4B. DIETHYL PHTHALATE	BDL	10
5B. DIMETHYL PHTHALATE	BDL	10
6B. DI-N-BUTYL PHTHALATE	BDL	10
7B. 2,4-DINITROTOLUENE	BDL	10
8B. 2,6-DINITROTOLUENE	BDL	10
9B. DI-N-OCTYL PHTHALATE	BDL	10
0B. 1,2-DIPHENYLHYDRAZINE	BDL	10
B. FLUORANTHENE	BDL	10

BDL-BELOW DETECTION LIMIT

WELL MONITORING ANALYSIS REPORT

WELL ST-4S

ENVIRONMENTAL LAB #: 746

SITE: CWM (Interlake)

WELL POINT #: C-628

DATE SAMPLED: 5-4-82

LAB MANAGER: John W. Givens
6-16-82

Test	Results	Date Complete	Test	Results
Depth, m			Hardness, as CaCO ₃ , mg/l	
Stick-up, m			Nitrate, as N, mg/l	0.06
Temperature, °C			Nitrogen, Ammonia, as N, mg/l	57.9
			Sulfate, as SO ₄ , mg/l	72.4
			Phosphate, as PO ₄ , mg/l	40.01
pH, units			Cyanide, as CN, mg/l	0.14
Conductivity, mS			Oil and Grease, mg/l	
Thallium, as Tl, mg/l	✓		Phenol, mg/l	40.010
Molybdenum, as Mo, mg/l	✓			
Arsenic, as As, mg/l	✓ 0.005			
Barium, as Ba, mg/l	✓ 0.296		Total Dissolved Solids, mg/l @ 180° C	
Boron, as B, mg/l	✓ 2.42		Total Suspended Solids, mg/l @ 105° C	
Cadmium, as Cd, mg/l	✓ 0.018		Residue on Evaporation @ 180° C	
Calcium, as Ca, mg/l	✓ 12.6		Cobalt, as Co, mg/l	0.012
Chromium, Total as Cr, mg/l	✓ 0.034		Vanadium, as V, mg/l	1.79
Hexavalent Chromium, as Cr, mg/l	✓ 0.02		Radium	
Copper, as Cu, mg/l	✓ 40.002		Gross Alpha	
Iron, total as Fe, mg/l	✓ 0.089		Gross Beta	
Iron, dissolved as Fe, mg/l	✓ 40.005			
Lead, as Pb, mg/l	✓ 0.006			
Manganese, as Mn, mg/l	✓ 0.076		Total Organic Carbon, mg/l	
Magnesium, as Mg, mg/l	✓ 254.		Total Organic Halogen, mg/l	
Mercury, as Hg, mg/l	✓ 0.0001			
Nickel, as Ni, mg/l	✓ 0.089			
Potassium, as K, mg/l	✓ 95.5		Endrin, mg/l	
Selenium, as Se, mg/l	✓ 40.005		Lindane, mg/l	
Silver, as Ag, mg/l	✓ 40.003		Methoxychlor, mg/l	
Sodium, as Na, mg/l	✓ 148.		2, 4D, mg/l	
Zinc, as Zn, mg/l	✓ 40.004		2, 4, 5 TP (Silvex) mg/l	
Beryllium, as Be, mg/l	✓ 40.001			
Antimony, as Sb, mg/l	✓ 0.238			
Alkalinity, as CaCO ₃ , mg/l			Fecal Coliform	
Chloride, as Cl, mg/l	✓ 319.			
COD mg/l	✓ 83.2		Priority Pollutant Scan	✓
Fluorides, as F, mg/l	✓ 1.3			

PHYSICAL APPEARANCE: _____

SAMPLE IDENTIFICATION: Interlake #2

TECHNICAL CENTER SAMPLE NUMBER: ENV 746

VOLATILE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	ACROLEIN	BDL	100
2V.	ACRYLONITRILE	BDL	100
3V.	BENZENE	720	10
4V.	BIS (CHLOROMETHYL) ETHER	BDL	10
5V.	BROMOFORM	BDL	10
6V.	CARBON TETRACHLORIDE	BDL	10
7V.	CHLOROBENZENE	BDL	10
8V.	CHLORODIBROMOMETHANE	BDL	10
9V.	CHLOROETHANE	BDL	10
10V.	2-CHLOROETHYL VINYL ETHER	BDL	10
11V.	CHLOROFORM	BDL	10
12V.	DICHLOROBROMOMETHANE	BDL	10
13V.	DICHLORODIFLUOROMETHANE	BDL	10
14V.	1,1-DICHLOROETHANE	BDL	10
15V.	1,2-DICHLOROETHANE	BDL	10
16V.	1,1-DICHLOROETHYLENE	BDL	10
17V.	1,2-DICHLOROPROPANE	BDL	10
18V.	1,3-DICHLOROPROPYLENE	BDL	10
19V.	ETHYLBENZENE	BDL	10
20V.	METHYL BROMIDE	BDL	10
21V.	METHYL CHLORIDE	BDL	10
22V.	METHYLENE CHLORIDE	BDL	10
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	10
24V.	TETRACHLOROETHYLENE	BDL	10
25V.	TOLUENE	360	10
26V.	1,2-TRANS-DICHLOROETHYLENE	BDL	10
27V.	1,1,1-TRICHLOROETHANE	BDL	10
28V.	1,1,2-TRICHLOROETHANE	BDL	10
29V.	TRICHLOROETHYLENE	BDL	10
30V.	TRICHLOROFLUOROMETHANE	BDL	10
31V.	VINYL CHLORIDE	BDL	10

BDL=BELOW DETECTION LIMIT

SAMPLE IDENTIFICATION: Interlake #2

TECHNICAL CENTER SAMPLE NUMBER: ENV 746

BASE-NEUTRAL EXTRACTABLE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1B.	ACENAPHTHENE	BDL	10
2B.	ACENAPHTHYLENE	BDL	10
3B.	ANTHRACENE	BDL	10
4B.	BENZIDINE	BDL	10
5B.	BENZO (A) ANTHRACENE	BDL	10
6B.	BENZO (A) PYRENE	BDL	10
7B.	3,4-BENZOFLUORANTHENE	BDL	10
8B.	BENZO (GHI) PERYLENE	BDL	25
9B.	BENZO (K) FLUORANTHENE	BDL	10
0B.	BIS (2-CHLOROETHOXY) METHANE	BDL	10
1B.	BIS (2-CHLOROETHYL) ETHER	BDL	10
2B.	BIS (2-CHLOROISOPROPYL) ETHER	BDL	10
3B.	BIS (2-ETHYLHEXYL) PHTHALATE	BDL	10
4B.	4-BROMOPHENYL PHENYL ETHER	BDL	10
5B.	BUTYL BENZYL PHTHALATE	BDL	10
6B.	2-CHLORONAPHTHALENE	BDL	10
7B.	4-CHLOROPHENYL PHENYL ETHER	BDL	10
8B.	CHRYSENE	BDL	10
9B.	DIBENZO (A,H) ANTHRACENE	BDL	25
0B.	1,2-DICHLOROBENZENE	BDL	10
1B.	1,3-DICHLOROBENZENE	BDL	10
2B.	1,4-DICHLOROBENZENE	BDL	10
3B.	3,3'-DICHLOROBENZIDINE	BDL	10
4B.	DIETHYL PHTHALATE	BDL	10
5B.	DIMETHYL PHTHALATE	BDL	10
6B.	DI-N-BUTYL PHTHALATE	BDL	10
7B.	2,4-DINITROTOLUENE	BDL	10
8B.	2,6-DINITROTOLUENE	BDL	10
9B.	DI-N-OCTYL PHTHALATE	BDL	10
0B.	1,2-DIPHENYLHYDRAZINE	BDL	10
B.	FLUORANTHENE	BDL	10

BDL-BELOW DETECTION LIMIT

WELL MONITORING ANALYSIS REPORT

WELL SS-1D

ENVIRONMENTAL LAB #: 770

SITE: CWM (Interlake)

WELL POINT #: C-633

DATE SAMPLED: 5-7-82

LAB MANAGER: John W. Kligman

Test	Results	Date Complete	Test	Results	Cc
Depth, m			Hardness, as CaCO ₃ , mg/l		
Stick-up, m			Nitrate, as N, mg/l	✓ 0.68	
Temperature, °C			Nitrogen, Ammonia, as N, mg/l	✓ 0.34	
			Sulfate, as SO ₄ , mg/l	✓ 43.4	
			Phosphate, as PO ₄ , mg/l	✓ 40.05	
pH, units			Cyanide, as CN, mg/l	✓ 0.11	
Conductivity, mS			Oil and Grease, mg/l		
Thallium, as Tl, mg/l	✓		Phenol, mg/l	✓ 40.010	
Molybdenum, as Mo, mg/l	✓				
Arsenic, as As, mg/l	✓ 40.005				
Barium, as Ba, mg/l	✓ 0.005		Total Dissolved Solids, mg/l @ 180° C		
Boron, as B, mg/l	✓ 0.998		Total Suspended Solids, mg/l @ 105° C		
Cadmium, as Cd, mg/l	✓ 0.002		Residue on Evaporation @ 180° C		
Calcium, as Ca, mg/l	✓ 5.05		Cadmium, as Cd, mg/l	✓ 0.003	
Chromium, Total as Cr, mg/l	✓ 0.057		Vanadium, as V, mg/l	✓ 0.035	
Hexavalent Chromium, as Cr, mg/l	0.04		Radium		
Copper, as Cu, mg/l	✓ 0.012		Gross Alpha		
Iron, total as Fe, mg/l	✓ 0.094		Gross Beta		
Iron, dissolved as Fe, mg/l	✓ 40.005				
Lead, as Pb, mg/l	✓ 40.005				
Manganese, as Mn, mg/l	✓ 0.001		Total Organic Carbon, mg/l		
Magnesium, as Mg, mg/l	✓ 0.105		Total Organic Halogen, mg/l		
Mercury, as Hg, mg/l	✓ 0.0002				
Nickel, as Ni, mg/l	✓ 0.007				
Potassium, as K, mg/l	✓ 121.		Endrin, mg/l		
Selenium, as Se, mg/l	✓ 40.005		Lindane, mg/l		
Silver, as Ag, mg/l	✓ 0.016		Methoxychlor, mg/l		
Sodium, as Na, mg/l	✓ 96.0		2,4D, mg/l		
Zinc, as Zn, mg/l	✓ 0.027		2,4,5 TP (Silvex) mg/l		
Antimony, as Sb, mg/l	✓ 0.008				
Beryllium, as Be, mg/l	✓ 0.0008				
Alkalinity, as CaCO ₃ , mg/l			Fecal Coliform		
Chloride, as Cl, mg/l	✓ 48.1				
COD mg/l	✓ 533.		Priorit. Pollutant Screen	✓	
Fluorides, as F, mg/l	✓ 1.2				

PHYSICAL APPEARANCE: _____

SAMPLE IDENTIFICATION: Interlake #7

TECHNICAL CENTER SAMPLE NUMBER: ENV 770

VOLATILE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	ACROLEIN	BDL	100
2V.	ACRYLONITRILE	BDL	100
3V.	BENZENE	620	10
4V.	BIS (CHLOROMETHYL) ETHER	BDL	10
5V.	BROMOFORM	BDL	10
6V.	CARBON TETRACHLORIDE	BDL	10
7V.	CHLOROBENZENE	BDL	10
8V.	CHLORODIBROMOMETHANE	BDL	10
9V.	CHLOROETHANE	BDL	10
10V.	2-CHLOROETHYL VINYL ETHER	BDL	10
11V.	CHLOROFORM	BDL	10
12V.	DICHLOROBROMOMETHANE	BDL	10
13V.	DICHLORODIFLUOROMETHANE	BDL	10
14V.	1,1-DICHLOROETHANE	BDL	10
15V.	1,2-DICHLOROETHANE	BDL	10
16V.	1,1-DICHLOROETHYLENE	BDL	10
17V.	1,2-DICHLOROPROPANE	BDL	10
18V.	1,3-DICHLOROPROPYLENE	BDL	10
19V.	ETHYLBENZENE	BDL	10
20V.	METHYL BROMIDE	BDL	10
21V.	METHYL CHLORIDE	BDL	10
22V.	METHYLENE CHLORIDE	BDL	10
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	10
24V.	TETRACHLOROETHYLENE	BDL	10
25V.	TOLUENE	BDL	10
26V.	1,2-TRANS-DICHLOROETHYLENE	BDL	10
27V.	1,1,1-TRICHLOROETHANE	BDL	10
28V.	1,1,2-TRICHLOROETHANE	BDL	10
29V.	TRICHLOROETHYLENE	BDL	10
30V.	TRICHLOROFLUOROMETHANE	BDL	10
31V.	VINYL CHLORIDE	BDL	10

BDL=BELOW DETECTION LIMIT

WELL MONITORING ANALYSIS REPORT

WELL SS-2D

ENVIRONMENTAL LAB #: 780

SITE: CWM (Interlake)

WELL POINT #: C-636

DATE SAMPLED: 5-11-82

LAB MANAGER: J. W. Kaganis
6-16-82

Test	Results	Date Complete	Test	Results	Cc
Depth, m			Hardness, as CaCO ₃ , mg/l		
Stick-up, m			Nitrate, as N, mg/l	✓ 0.68	
Temperature, °C			Nitrogen, Ammonia, as N, mg/l	✓ 0.54	
			Sulfate, as SO ₄ , mg/l	✓ 60.2	
			Phosphate, as PO ₄ , mg/l	✓ 0.012	
pH, units			Cyanide, as CN, mg/l	✓ 0.22	
Conductivity, mS			Oil and Grease, mg/l		
Thallium, as Tl, mg/l	✓		Phenol, mg/l	✓ <0.010	
Molybdenum, as Mo, mg/l	✓				
Arsenic, as As, mg/l	✓	0.008			
Barium, as Ba, mg/l	✓	0.021	Total Dissolved Solids, mg/l @ 180° C		
Boron, as B, mg/l	✓	0.578	Total Suspended Solids, mg/l @ 105° C		
Cadmium, as Cd, mg/l	✓	0.001	Residue on Evaporation @ 180° C		
Calcium, as Ca, mg/l	✓	18.2	Cobalt, as Co, mg/l	✓ 0.004	
Chromium, Total as Cr, mg/l	✓	0.015	Niobium, as V, mg/l	✓ 0.033	
Hexavalent Chromium, as Cr, mg/l		0.015	Radium		
Copper, as Cu, mg/l	✓	0.011	Gross Alpha		
Iron, total as Fe, mg/l	✓	0.033	Gross Beta		
Iron, dissolved as Fe, mg/l	✓	<0.005			
Lead, as Pb, mg/l	✓	<0.005			
Manganese, as Mn, mg/l	✓	0.001	Total Organic Carbon, mg/l		
Magnesium, as Mg, mg/l	✓	0.154	Total Organic Halogen, mg/l		
Mercury, as Hg, mg/l	✓	0.0001			
Nickel, as Ni, mg/l	✓	0.010			
Potassium, as K, mg/l	✓	71.7	Endrin, mg/l		
Selenium, as Se, mg/l	✓	<0.005	Lindane, mg/l		
Silver, as Ag, mg/l	✓	0.010	Methoxychlor, mg/l		
Sodium, as Na, mg/l	✓	52.4	2, 4D, mg/l		
Zinc, as Zn, mg/l	✓	<0.004	2, 4, 5 TP (Silvex) mg/l		
Antimony, as Sb, mg/l	✓	0.019			
Beryllium, as Be, mg/l	✓	0.0003			
Alkalinity, as CaCO ₃ , mg/l			Fecal Coliform		
Chloride, as Cl, mg/l	✓	27.7			
COD mg/l	✓	17.0	Priority Pollutant Scan	✓	
Fluorides, as F, mg/l	✓	0.8			

PHYSICAL APPEARANCE: _____

SAMPLE IDENTIFICATION: Interlake #10

TECHNICAL CENTER SAMPLE NUMBER: ENV 780

VOLATILE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	ACROLEIN	BDL	100
2V.	ACRYLONITRILE	BDL	100
3V.	BENZENE	770	10
4V.	BIS (CHLOROMETHYL) ETHER	BDL	10
5V.	BROMOFORM	BDL	10
6V.	CARBON TETRACHLORIDE	BDL	10
7V.	CHLOROBENZENE	BDL	10
8V.	CHLORODIBROMOMETHANE	BDL	10
9V.	CHLOROETHANE	BDL	10
10V.	2-CHLOROETHYL VINYL ETHER	BDL	10
11V.	CHLOROFORM	BDL	10
12V.	DICHLOROBROMOMETHANE	BDL	10
13V.	DICHLORODIFLUOROMETHANE	BDL	10
14V.	1,1-DICHLOROETHANE	BDL	10
15V.	1,2-DICHLOROETHANE	BDL	10
16V.	1,1-DICHLOROETHYLENE	BDL	10
17V.	1,2-DICHLOROPROPANE	BDL	10
18V.	1,3-DICHLOROPROPYLENE	BDL	10
19V.	ETHYLBENZENE	BDL	10
20V.	METHYL BROMIDE	BDL	10
21V.	METHYL CHLORIDE	BDL	10
22V.	METHYLENE CHLORIDE	BDL	10
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	10
24V.	TETRACHLOROETHYLENE	BDL	10
25V.	TOLUENE	BDL	10
26V.	1,2-TRANS-DICHLOROETHYLENE	BDL	10
27V.	1,1,1-TRICHLOROETHANE	BDL	10
28V.	1,1,2-TRICHLOROETHANE	BDL	10
29V.	TRICHLOROETHYLENE	BDL	10
30V.	TRICHLOROFLUOROMETHANE	BDL	10
31V.	VINYL CHLORIDE		

BDL=BELOW DETECTION LIMIT

WELL MONITORING ANALYSIS REPORT

WELL ST-1D

ENVIRONMENTAL LAB #: 769

SITE: Cwm (Interlake)

WELL POINT #: C-632

DATE SAMPLED: 5-7-82

LAB MANAGER: John W. Klagan
6-16-82

Test	Results	Date Complete	Test	Results	C
Depth, m			Hardness, as CaCO ₃ , mg/l		
Stick-up, m			Nitrate, as N, mg/l	✓ 1.74	
Temperature, °C			Nitrogen, Ammonia, as N, mg/l	✓ 0.25	
			Sulfate, as SO ₄ , mg/l	✓ 40.6	
			Phosphate, as PO ₄ , mg/l	✓ 40.05	
pH, units			Cyanide, as CN, mg/l	✓ 0.45	
Conductivity, mS			Oil and Grease, mg/l		
Thallium as Tl, mg/l	✓		Phenol, mg/l	✓ 40.010	
Molybdenum as Mo, mg/l	✓				
Arsenic, as As, mg/l	✓ 40.005				
Barium, as Ba, mg/l	✓ 0.109		Total Dissolved Solids, mg/l @ 180° C		
Boron, as B, mg/l	✓ 0.920		Total Suspended Solids, mg/l @ 105° C		
Cadmium, as Cd, mg/l	✓ 0.054		Residue on Evaporation @ 180° C		
Calcium, as Ca, mg/l	✓ 17.0		Cobalt, as Co, mg/l	✓ 0.256	
Chromium, Total as Cr, mg/l	✓ 0.140		Vanadium, as V, mg/l	✓ 0.317	
Hexavalent Chromium, as Cr, mg/l	✓ 0.140		Radium		
Copper, as Cu, mg/l	✓ 0.141		Gross Alpha		
Iron, total as Fe, mg/l	✓ 8.28		Gross Beta		
Iron, dissolved as Fe, mg/l	✓ 0.980				
Lead, as Pb, mg/l	✓ 40.005				
Manganese, as Mn, mg/l	✓ 0.131		Total Organic Carbon, mg/l		
Magnesium, as Mg, mg/l	✓ 10.3		Total Organic Halogen, mg/l		
Mercury, as Hg, mg/l	✓ 40.0001				
Nickel, as Ni, mg/l	✓ 0.265				
Potassium, as K, mg/l	✓ 2140.		Endrin, mg/l		
Selenium, as Se, mg/l	✓ 40.005		Lindane, mg/l		
Silver, as Ag, mg/l	✓ 0.193		Methoxychlor, mg/l		
Sodium, as Na, mg/l	✓ 201.		2, 4D, mg/l		
Zinc, as Zn, mg/l	✓ 0.084		2, 4, 5 TP (Silvex) mg/l		
Antimony, as Sb, mg/l	✓ 0.881				
Beryllium as Be, mg/l	✓ 0.015				
Alkalinity, as CaCO ₃ , mg/l			Fecal Coliform		
Chloride, as Cl, mg/l	✓ 53.7				
COD mg/l	✓ 83.2		Priority Pollutant Scan	✓	
Fluorides, as F, mg/l	✓ 1.4				

PHYSICAL APPEARANCE: _____

SAMPLE IDENTIFICATION: Interlake #6

TECHNICAL CENTER SAMPLE NUMBER: ENV 769

VOLATILE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
		BDL	100
1V.	ACROLEIN	BDL	100
2V.	ACRYLONITRILE	900	10
3V.	BENZENE		10
4V.	BIS (CHLOROMETHYL) ETHER		10
5V.	BROMOFORM	BDL	10
6V.	CARBON TETRACHLORIDE	BDL	10
7V.	CHLOROBENZENE	BDL	10
8V.	CHLORODIBROMOMETHANE	BDL	10
9V.	CHLOROETHANE	BDL	10
10V.	2-CHLOROETHYL VINYL ETHER	BDL	10
11V.	CHLOROFORM	BDL	10
12V.	DICHLOROBROMOMETHANE	BDL	10
13V.	DICHLORODIFLUOROMETHANE	BDL	10
14V.	1,1-DICHLOROETHANE	BDL	10
15V.	1,2-DICHLOROETHANE	BDL	10
16V.	1,1-DICHLOROETHYLENE	BDL	10
17V.	1,2-DICHLOROPROPANE	BDL	10
18V.	1,3-DICHLOROPROPYLENE	BDL	10
19V.	ETHYLBENZENE	BDL	10
20V.	METHYL BROMIDE	BDL	10
21V.	METHYL CHLORIDE	BDL	10
22V.	METHYLENE CHLORIDE	BDL	10
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	10
24V.	TETRACHLOROETHYLENE	150	10
25V.	TOLUENE		10
26V.	1,2-TRANS-DICHLOROETHYLENE		10
27V.	1,1,1-TRICHLOROETHANE	BDL	10
28V.	1,1,2-TRICHLOROETHANE	BDL	10
29V.	TRICHLOROETHYLENE	BDL	10
30V.	TRICHLOROFLUOROMETHANE	BDL	10
31V.	VINYL CHLORIDE		

BDL=BELOW DETECTION LIMIT

FILE IDENTIFICATION:

Interlake #6

TECHNICAL CENTER SAMPLE NUMBER:

ENV 769

BASE-NEUTRAL EXTRACTABLE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1B.	ACENAPHTHENE	BDL	10
2B.	ACENAPHTHYLENE	BDL	10
3B.	ANTHRACENE	BDL	10
4B.	BENZIDINE	BDL	10
5B.	BENZO (A) ANTHRACENE	BDL	10
6B.	BENZO (A) PYRENE	BDL	10
7B.	3,4-BENZOFLUORANTHENE	BDL	10
8B.	BENZO (GHI) PERYLENE	BDL	25
9B.	BENZO (K) FLUORANTHENE	BDL	10
10B.	BIS (2-CHLOROETHOXY) METHANE	BDL	10
11B.	BIS (2-CHLOROETHYL) ETHER	BDL	10
12B.	BIS (2-CHLOROISOPROPYL) ETHER	BDL	10
13B.	BIS (2-ETHYLHEXYL) PHTHALATE	BDL	10
14B.	4-BROMOPHENYL PHENYL ETHER	BDL	10
15B.	BUTYL BENZYL PHTHALATE	BDL	10
16B.	2-CHLORONAPHTHALENE	BDL	10
17B.	4-CHLOROPHENYL PHENYL ETHER	BDL	10
18B.	CHRYSENE	BDL	10
19B.	DIBENZO (A,H) ANTHRACENE	BDL	25
20B.	1,2-DICHLOROBENZENE	BDL	10
21B.	1,3-DICHLOROBENZENE	BDL	10
22B.	1,4-DICHLOROBENZENE	BDL	10
23B.	3,3'-DICHLOROBENZIDINE	BDL	10
24B.	DIETHYL PHTHALATE	BDL	10
25B.	DIMETHYL PHTHALATE	BDL	10
26B.	DI-N-BUTYL PHTHALATE	BDL	10
27B.	2,4-DINITROTOLUENE	BDL	10
28B.	2,6-DINITROTOLUENE	BDL	10
29B.	DI-N-OCTYL PHTHALATE	BDL	10
30B.	1,2-DIPHENYLHYDRAZINE	BDL	10
31B.	FLUORANTHENE	BDL	10

Plasticizer from well

29

BDL-BELOW DETECTION LIMIT

WELL MONITORING ANALYSIS REPORT

WELL ST-2D

ENVIRONMENTAL LAB #: 765

SITE: CWM (Interlake)

WELL POINT #: C-629

DATE SAMPLED: 5-5-82

LAB MANAGER: John W. Klayman
6-16-82

Test	Results	Date Complete	Test	Results
Depth, m			Hardness, as CaCO ₃ , mg/l	
Stick-up, m			Nitrate, as N, mg/l	✓ 0.16
Temperature, °C			Nitrogen, Ammonia, as N, mg/l	✓ 0.81
			Sulfate, as SO ₄ , mg/l	✓ 242.
			Phosphate, as PO ₄ , mg/l	✓ <0.01
pH, units			Cyanide, as CN, mg/l	✓ 2.96
Conductivity, mS			Oil and Grease, mg/l	
Thallium, as Tl, mg/l	✓		Phenol, mg/l	✓ <0.010
Molybdenum, as Mo, mg/l	✓			
Arsenic, as As, mg/l	✓ <0.005			
Barium, as Ba, mg/l	✓ 0.051		Total Dissolved Solids, mg/l @ 180° C	
Boron, as B, mg/l	✓ 0.870		Total Suspended Solids, mg/l @ 105° C	
Cadmium, as Cd, mg/l	✓ 0.054		Residue on Evaporation @ 180° C	
Calcium, as Ca, mg/l	✓ 77.7		Cobalt, as Co, mg/l	✓ 0.242
Chromium, Total as Cr, mg/l	✓ 0.315		Vanadium, as V, mg/l	✓ 0.311
Hexavalent Chromium, as Cr, mg/l	✓ 0.02		Radium	
Copper, as Cu, mg/l	✓ 0.136		Gross Alpha	
Iron, total as Fe, mg/l	✓ 0.214		Gross Beta	
Iron, dissolved as Fe, mg/l	✓ 0.052			
Lead, as Pb, mg/l	✓ <0.005			
Manganese, as Mn, mg/l	✓ 0.084		Total Organic Carbon, mg/l	
Magnesium, as Mg, mg/l	✓ 26.8		Total Organic Halogen, mg/l	
Mercury, as Hg, mg/l	✓ 0.0002			
Nickel, as Ni, mg/l	✓ 0.273			
Potassium, as K, mg/l	✓ 2100.		Endrin, mg/l	
Selenium, as Se, mg/l	✓ <0.005		Lindane, mg/l	
Silver, as Ag, mg/l	✓ 0.190		Methoxychlor, mg/l	
Sodium, as Na, mg/l	✓ 169.		2, 4D, mg/l	
Zinc, as Zn, mg/l	✓ 0.049		2, 4, 5 TP (Silvex) mg/l	
Beryllium, as Be, mg/l	✓ 0.011			
Antimony, as Sb, mg/l	✓ 0.824			
Alkalinity, as CaCO ₃ , mg/l			Fecal Coliform	
Chloride, as Cl, mg/l	✓ 56.9			
COD mg/l	✓ 458.		Priority Pollutant	✓
Fluorides, as F, mg/l	✓ 0.9		scm	

PHYSICAL APPEARANCE: _____

SAMPLE IDENTIFICATION: Interlake #3

TECHNICAL CENTER SAMPLE NUMBER: ENV 765

PESTICIDES/PCB'S	CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1P. ALDRIN	BDL	10
2P. ALPHA-BHC	BDL	10
3P. BETA-BHC	BDL	10
4P. GAMMA-BHC	BDL	10
5P. DELTA-BHC	BDL	10
6P. CHLORDANE	BDL	10
7P. 4,4'-DDT	BDL	10
8P. 4,4'-DDE	BDL	10
9P. 4,4'-DDD	BDL	10
10P. DIELDRIN	BDL	10
11P. ALPHA-ENDOSULFAN	BDL	10
12P. BETA-ENDOSULFAN	BDL	10
13P. ENDOSULFAN SULFATE	BDL	10
14P. ENDRIN	BDL	10
15P. ENDRIN ALDEHYDE	BDL	10
16P. HEPTACHLOR	BDL	10
17P. HEPTACHLOR EPOXIDE	BDL	10
18P. PCB-1242	BDL	10
19P. PCB-1254	BDL	10
20P. PCB-1221	BDL	10
21P. PCB-1232	BDL	10
22P. PCB-1248	BDL	10
23P. PCB-1260	BDL	10
24P. PCB-1016	BDL	10
25P. TOXAPHENE	BDL	10

BDL=BELOW DETECTION LIMIT

SAMPLE IDENTIFICATION: Interlake #3

TECHNICAL CENTER SAMPLE NUMBER: ENV 765

BASE-NEUTRAL EXTRACTABLE ORGANICS	CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1B. ACENAPHTHENE	BDL	10
2B. ACENAPHTHYLENE	BDL	10
3B. ANTHRACENE	BDL	10
4B. BENZIDINE	BDL	10
5B. BENZO (A) ANTHRACENE	BDL	10
6B. BENZO (A) PYRENE	BDL	10
7B. 3,4-BENZOFUORANTHENE	BDL	10
8B. BENZO (GHI) PERYLENE	BDL	25
9B. BENZO (K) FLUORANTHENE	BDL	10
OB. BIS (2-CHLOROETHOXY) METHANE	BDL	10
1B. BIS (2-CHLOROETHYL) ETHER	BDL	10
2B. BIS (2-CHLOROISOPROPYL) ETHER	BDL	10
3B. BIS (2-ETHYLHEXYL) PHTHALATE	BDL	10
4B. 4-BROMOPHENYL PHENYL ETHER	BDL	10
5B. BUTYL BENZYL PHTHALATE	BDL	10
6B. 2-CHLORONAPHTHALENE	BDL	10
7B. 4-CHLOROPHENYL PHENYL ETHER	BDL	10
8B. CHRYSENE	BDL	10
9B. DIBENZO (A,H) ANTHRACENE	BDL	25
OB. 1,2-DICHLOROBENZENE	BDL	10
1B. 1,3-DICHLOROBENZENE	BDL	10
2B. 1,4-DICHLOROBENZENE	BDL	10
3B. 3,3'-DICHLOROBENZIDINE	BDL	10
4B. DIETHYL PHTHALATE	BDL	10
5B. DIMETHYL PHTHALATE	BDL	10
5B. DI-N-BUTYL PHTHALATE	BDL	10
7B. 2,4-DINITROTOLUENE	BDL	10
3B. 2,6-DINITROTOLUENE	BDL	10
9B. DI-N-OCTYL PHTHALATE	BDL	10
OB. 1,2-DIPHENYLHYDRAZINE	BDL	10
1B. FLUORANTHENE	BDL	10

BDL-BELOW DETECTION LIMIT

WELL MONITORING ANALYSIS REPORT

WELL SS-3D

ENVIRONMENTAL LAB #: 781

SITE: CWM (Interlake)

WELL POINT #: C-637

DATE SAMPLED: 5-11-82

LAB MANAGER: John W. Kalamian

Test	Results	Date Complete	Test	Results	Co
Depth, m			Hardness, as CaCO ₃ , mg/l		
Stick-up, m			Nitrate, as N, mg/l	✓ 1.28	
Temperature, °C			Nitrogen, Ammonia, as N, mg/l	✓ 3.23	
			Sulfate, as SO ₄ , mg/l	✓ 213.	
			Phosphate, as PO ₄ , mg/l	✓ <0.01	
pH, units			Cyanide, as CN, mg/l	✓ 0.14	
Conductivity, mS			Oil and Grease, mg/l		
<u>Thallium, as Tl, mg/l</u> ✓			Phenol, mg/l	✓ <0.010	
<u>Molybdenum, as Mo, mg/l</u> ✓					
Arsenic, as As, mg/l	✓ 0.003				
Barium, as Ba, mg/l	✓ 0.033		Total Dissolved Solids, mg/l @ 180° C		
Boron, as B, mg/l	✓ 1.86		Total Suspended Solids, mg/l @ 105° C		
Cadmium, as Cd, mg/l	✓ 0.002		Residue on Evaporation @ 180° C		
Calcium, as Ca, mg/l	✓ 25.9		Cobalt, as Co, mg/l	✓ 0.003	
Chromium, Total as Cr, mg/l	✓ 0.003		Vanadium, as V, mg/l	✓ 0.113	
Hexavalent Chromium, as Cr, mg/l	✓		Radium		
Copper, as Cu, mg/l	✓ 0.005		Gross Alpha		
Iron, total as Fe, mg/l	✓ 0.066		Gross Beta		
Iron, dissolved as Fe, mg/l	✓ 0.030				
Lead, as Pb, mg/l	✓				
Manganese, as Mn, mg/l	✓ 0.015		Total Organic Carbon, mg/l		
Magnesium, as Mg, mg/l	✓ 14.2		Total Organic Halogen, mg/l		
Mercury, as Hg, mg/l	✓ 0.002				
Nickel, as Ni, mg/l	✓ 0.021				
Potassium, as K, mg/l	✓ 27.9		Endrin, mg/l		
Selenium, as Se, mg/l	✓ 0.001		Lindane, mg/l		
Silver, as Ag, mg/l	✓ 0.006		Methoxychlor, mg/l		
Sodium, as Na, mg/l	✓ 164.		2, 4D, mg/l		
Zinc, as Zn, mg/l	✓ <0.004		2, 4, 5 TP (Silvex) mg/l		
<u>Antimony, as Sb, mg/l</u> ✓	0.030				
<u>Beryllium, as Be, mg/l</u> ✓	0.0002				
Alkalinity, as CaCO ₃ , mg/l			Fecal Coliform		
Chloride, as Cl, mg/l	✓ 112.				
COD mg/l	✓ 42.		Priority Pollutant Scan	✓	
Fluorides, as F, mg/l	✓ 0.8				

PHYSICAL APPEARANCE: _____

SAMPLE IDENTIFICATION: Interlake #11

TECHNICAL CENTER SAMPLE NUMBER: ENV 781

VOLATILE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	ACROLEIN	BDL	100
2V.	ACRYLONITRILE	BDL	100
3V.	BENZENE	790	10
4V.	BIS (CHLOROMETHYL) ETHER	BDL	10
5V.	BROMOFORM	BDL	10
6V.	CARBON TETRACHLORIDE	BDL	10
7V.	CHLOROBENZENE	BDL	10
8V.	CHLORODIBROMOMETHANE	BDL	10
9V.	CHLOROETHANE	BDL	10
10V.	2-CHLOROETHYL VINYL ETHER	BDL	10
11V.	CHLOROFORM	BDL	10
12V.	DICHLOROBROMOMETHANE	BDL	10
13V.	DICHLORODIFLUOROMETHANE	BDL	10
14V.	1,1-DICHLOROETHANE	BDL	10
15V.	1,2-DICHLOROETHANE	BDL	10
16V.	1,1-DICHLOROETHYLENE	BDL	10
17V.	1,2-DICHLOROPROPANE	BDL	10
18V.	1,3-DICHLOROPROPYLENE	BDL	10
19V.	ETHYLBENZENE	BDL	10
20V.	METHYL BROMIDE	BDL	10
21V.	METHYL CHLORIDE	BDL	10
22V.	METHYLENE CHLORIDE	BDL	10
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	10
24V.	TETRACHLOROETHYLENE	BDL	10
25V.	TOLUENE	BDL	10
26V.	1,2-TRANS-DICHLOROETHYLENE	BDL	10
27V.	1,1,1-TRICHLOROETHANE	BDL	10
28V.	1,1,2-TRICHLOROETHANE	BDL	10
29V.	TRICHLOROETHYLENE	BDL	10
30V.	TRICHLOROFLUOROMETHANE	BDL	10
31V.	VINYL CHLORIDE	BDL	10

BDL=BELOW DETECTION LIMIT

WELL MONITORING ANALYSIS REPORT

WELL ST-4D

ENVIRONMENTAL LAB #: 778

SITE: CWM (Interlake)

WELL POINT #: C-634

DATE SAMPLED: 5-11-82

LAB MANAGER: John W. Horgan
6-16-82

Test	Results	Date Complete	Test	Results	Co
Depth, m			Hardness, as CaCO ₃ , mg/l		
Stick-up, m			Nitrate, as N, mg/l	✓ 1.56	
Temperature, °C			Nitrogen, Ammonia, as N, mg/l	✓ 1.19	
			Sulfate, as SO ₄ , mg/l	✓ 103.	
			Phosphate, as PO ₄ , mg/l	✓ 0.015	
pH, units			Cyanide, as CN, mg/l	✓ 0.24	
Conductivity, mS			Oil and Grease, mg/l		
Thallium, as Tl, mg/l	✓		Phenol, mg/l	✓ 40.010	
Molybdenum, as Mo, mg/l	✓				
Arsenic, as As, mg/l	✓ 0.006				
Barium, as Ba, mg/l	✓ 0.196		Total Dissolved Solids, mg/l @ 180° C		
Boron, as B, mg/l	✓ 1.99		Total Suspended Solids, mg/l @ 105° C		
Cadmium, as Cd, mg/l	✓ 0.003		Residue on Evaporation @ 180° C		
Calcium, as Ca, mg/l	✓ 78.0		Cobalt, as Co, mg/l	✓ 0.001	
Chromium, Total as Cr, mg/l	✓ 0.016		Vanadium, as V, mg/l	✓ 0.344	
Hexavalent Chromium, as Cr, mg/l	✓ 0.016		Radium		
Copper, as Cu, mg/l	✓ 0.009		Gross Alpha		
Iron, total as Fe, mg/l	✓ 0.913		Gross Beta		
Iron, dissolved as Fe, mg/l	✓ 0.553				
Lead, as Pb, mg/l	✓ 0.005				
Manganese, as Mn, mg/l	✓ 0.025		Total Organic Carbon, mg/l		
Magnesium, as Mg, mg/l	✓ 42.9		Total Organic Halogen, mg/l		
Mercury, as Hg, mg/l	✓ 40.0001				
Nickel, as Ni, mg/l	✓ 0.033				
Potassium, as K, mg/l	✓ 46.6		Endrin, mg/l		
Selenium, as Se, mg/l	✓ 40.005		Lindane, mg/l		
Silver, as Ag, mg/l	✓ 0.005		Methoxychlor, mg/l		
Sodium, as Na, mg/l	✓ 172.		2,4D, mg/l		
Zinc, as Zn, mg/l	✓ 0.002		2,4,5 TP (Silvex) mg/l		
Antimony, as Sb, mg/l	✓ 0.087				
Beryllium, as Be, mg/l	✓ 0.0009				
Alkalinity, as CaCO ₃ , mg/l			Fecal Coliform		
Chloride, as Cl, mg/l	✓ 160.				
COD mg/l	✓ 192.		Priority Pollutant Screen	✓	
Fluorides, as F, mg/l	✓ 1.0				

PHYSICAL APPEARANCE: _____

SAMPLE IDENTIFICATION: Interlake #8

TECHNICAL CENTER SAMPLE NUMBER: ENV 778

VOLATILE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	ACROLEIN	BDL	100
2V.	ACRYLONITRILE	BDL	100
3V.	BENZENE	740	10
4V.	BIS (CHLOROMETHYL) ETHER	BDL	10
5V.	BROMOFORM	BDL	10
6V.	CARBON TETRACHLORIDE	BDL	10
7V.	CHLOROBENZENE	BDL	10
8V.	CHLORODIBROMOMETHANE	BDL	10
9V.	CHLOROETHANE	BDL	10
10V.	2-CHLOROETHYL VINYL ETHER	BDL	10
11V.	CHLOROFORM	BDL	10
12V.	DICHLOROBROMOMETHANE	BDL	10
13V.	DICHLORODIFLUOROMETHANE	BDL	10
14V.	1,1-DICHLOROETHANE	BDL	10
15V.	1,2-DICHLOROETHANE	BDL	10
16V.	1,1-DICHLOROETHYLENE	BDL	10
17V.	1,2-DICHLOROPROPANE	BDL	10
18V.	1,3-DICHLOROPROPYLENE	BDL	10
19V.	ETHYLBENZENE	BDL	10
20V.	METHYL BROMIDE	BDL	10
21V.	METHYL CHLORIDE	BDL	10
22V.	METHYLENE CHLORIDE	BDL	10
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	10
24V.	TETRACHLOROETHYLENE	BDL	10
25V.	TOLUENE	BDL	10
26V.	1,2-TRANS-DICHLOROETHYLENE	BDL	10
27V.	1,1,1-TRICHLOROETHANE	BDL	10
28V.	1,1,2-TRICHLOROETHANE	BDL	10
29V.	TRICHLOROETHYLENE	BDL	10
30V.	TRICHLOROFLUOROMETHANE	BDL	10
31V.	VINYL CHLORIDE	BDL	10

BDL=BELOW DETECTION LIMIT

WELL MONITORING ANALYSIS REPORT

"POTABLE" DRILLING WATER

ENVIRONMENTAL LAB #: 779

SITE: Cwm (Interlake)

WELL POINT #: C-635

DATE SAMPLED: 5-11-82

LAB MANAGER: John W. Kalye
6-16-82

Test	Results	Date Complete	Test	Results	C
Depth, m			Hardness, as CaCO ₃ , mg/l		
Stick-up, m			Nitrate, as N, mg/l	✓ 0.43	
Temperature, °C			Nitrogen, Ammonia, as N, mg/l	✓ 0.02	
			Sulfate, as SO ₄ , mg/l	✓ 29.1	
			Phosphate, as PO ₄ , mg/l	✓ 0.021	
pH, units			Cyanide, as CN, mg/l	✓ 0.10	
Conductivity, mS			Oil and Grease, mg/l		
Thallium, as Tl, mg/l	✓		Phenol, mg/l	✓ 0.010	
Molybdenum, as Mo, mg/l	✓				
Arsenic, as As, mg/l	✓ 0.005				
Barium, as Ba, mg/l	✓ 0.021		Total Dissolved Solids, mg/l @ 180° C		
Boron, as B, mg/l	✓ 0.004		Total Suspended Solids, mg/l @ 105° C		
Cadmium, as Cd, mg/l	✓ 0.004		Residue on Evaporation @ 180° C		
Calcium, as Ca, mg/l	✓ 32.5		Cobalt, as Co, mg/l	✓ 0.005	
Chromium, Total as Cr, mg/l	✓ 0.011		Vanadium, as V, mg/l	✓ 0.104	
Hexavalent Chromium, as Cr, mg/l	✓ 0.01		Radium		
Copper, as Cu, mg/l	✓ 0.006		Gross Alpha		
Iron, total as Fe, mg/l	✓ 0.037		Gross Beta		
Iron, dissolved as Fe, mg/l	✓ 0.005				
Lead, as Pb, mg/l	✓ 0.005				
Manganese, as Mn, mg/l	✓ 0.041		Total Organic Carbon, mg/l		
Magnesium, as Mg, mg/l	✓ 13.1		Total Organic Halogen, mg/l		
Mercury, as Hg, mg/l	✓ 0.0001				
Nickel, as Ni, mg/l	✓ 0.011				
Potassium, as K, mg/l	✓ 50.3		Endrin, mg/l		
Selenium, as Se, mg/l	✓ 0.005		Lindane, mg/l		
Silver, as Ag, mg/l	✓ 0.010		Methoxychlor, mg/l		
Sodium, as Na, mg/l	✓ 13.4		2, 4D, mg/l		
Zinc, as Zn, mg/l	✓ 0.004		2, 4, 5 TP (Silvex) mg/l		
Antimony, as Sb, mg/l	✓ 0.034				
Beryllium, as Be, mg/l	✓ 0.001				
Alkalinity, as CaCO ₃ , mg/l			Fecal Coliform		
Chloride, as Cl, mg/l	✓ 13.3				
COD mg/l	✓ 21.3		Priority Pollutant Scan 1		
Fluorides, as F, mg/l	✓ 1.1				

PHYSICAL APPEARANCE: _____

SAMPLE IDENTIFICATION: Interlake #9

TECHNICAL CENTER SAMPLE NUMBER: ENV 779

VOLATILE ORGANICS		CONCENTRATION (UG/L)	DETECTION LIMIT (UG/L)
1V.	ACROLEIN	BDL	100
2V.	ACRYLONITRILE	BDL	100
3V.	BENZENE	530	10
4V.	BIS (CHLOROMETHYL) ETHER	BDL	10
5V.	BROMOFORM	BDL	10
6V.	CARBON TETRACHLORIDE	BDL	10
7V.	CHLOROBENZENE	BDL	10
8V.	CHLORODIBROMOMETHANE	BDL	10
9V.	CHLOROETHANE	BDL	10
10V.	2-CHLOROETHYL VINYL ETHER	BDL	10
11V.	CHLOROFORM	BDL	10
12V.	DICHLOROBROMOMETHANE	BDL	10
13V.	DICHLORODIFLUOROMETHANE	BDL	10
14V.	1,1-DICHLOROETHANE	BDL	10
15V.	1,2-DICHLOROETHANE	BDL	10
16V.	1,1-DICHLOROETHYLENE	BDL	10
17V.	1,2-DICHLOROPROPANE	BDL	10
18V.	1,3-DICHLOROPROPYLENE	BDL	10
19V.	ETHYLBENZENE	BDL	10
20V.	METHYL BROMIDE	BDL	10
21V.	METHYL CHLORIDE	BDL	10
22V.	METHYLENE CHLORIDE	BDL	10
23V.	1,1,2,2-TETRACHLOROETHANE	BDL	10
24V.	TETRACHLOROETHYLENE	BDL	10
25V.	TOLUENE	BDL	10
26V.	1,2-TRANS-DICHLOROETHYLENE	BDL	10
27V.	1,1,1-TRICHLOROETHANE	BDL	10
28V.	1,1,2-TRICHLOROETHANE	BDL	10
29V.	TRICHLOROETHYLENE	BDL	10
30V.	TRICHLOROFLUOROMETHANE	BDL	10
31V.	VINYL CHLORIDE	BDL	10

BDL=BELOW DETECTION LIMIT

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX A
INTERLAKE SITE
CHICAGO, ILLINOIS

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Chloromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	3 0 J	--	--	0 9 J	4 0 J	--	2 0 J	4 0 J	2 0 J	2 0 J	3 0 J	3 0 J	36 0	3 0 J
Acetone	76 0 DJ	3200 0 D	300 0 D	99 0	880 0 DJ	11000 0 D	--	130 0 J	80 0 J	110 0 J	49 0 J	62 0 J	5000 0	--
Carbon Disulfide	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone	R	R	R	R	R	R	--	9 0 J	--	R	R	2 0 J	310 0 J	R
1,1,1-Trichloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Acetate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX A
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Dibromochloromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--	--	48.0	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	--	1.0 J	--	--
Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (total)	--	--	--	--	--	--	--	0.5 J	--	--	--	--	--	--
Fluorene	--	--	--	--	--	--	--	--	360.0 J	--	130.0 J	25.0 J	93.0 J	--
4-Nitroaniline	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,6-Dinitro-2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Bromophenyl Phenylether	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX A
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Pentachlorophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	0.4 J	--	--	--	0.5 J	610.0 J	--	5200.0	240.0 J	1600.0	540.0 J	690.0 J	260.0 J
Anthracene	--	--	--	--	--	--	48.0 J	--	810.0 J	--	250.0 J	90.0 J	51.0 J	--
Dibutylphthalate	--	0.2 J	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	--	--	970.0 J	--	5100.0	370.0 J	2800.0	990.0	--	590.0 J
Pyrene	--	--	--	--	--	--	880.0 J	--	4600.0	330.0 J	2700.0	940.0	--	670.0 J
Butylbenzylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3'-Dichlorobenzidine	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	640.0 J	--	4500.0	--	2800.0	460.0 J	--	40.0 J
Chrysene	--	--	--	--	--	--	420.0 J	--	4500.0	--	2300.0	410.0 J	--	290.0 J
Bis(2-ethylhexyl)phthalate	--	0.2 J	1.0 J	--	9.0 J	--	--	--	--	--	--	--	--	--
Di-n-octyl phthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	510.0 J	--	7400.0	--	5000.0	430.0 J	--	--
Benzo(k)fluoranthene	--	--	--	--	--	--	--	--	3700.0	--	3400.0	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	4100.0	--	4600.0	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--	--	--	--	--	4800.0	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Alpha-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beta-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX A
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Delta-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gamma-BHC (Lindane)	--	--	--	--	--	--	--	69 8 J	--	--	--	--	--	--
Heptachlor	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endrin	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan I	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dieldrin	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan II	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan sulfate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethyl)ether	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	120 0 J	--
Bis(2-chloroisopropyl)ether	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	5000 0	--
N-Nitrosodi-n-propylamine	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX A
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Hexachloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nitrobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Isophorene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzoic acid	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethyl)methane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	--	--	--	--	--	0.2 J	760.0 J	--	210.0 J	88.0 J	96.0 J	--	1200.0 J	14.0 J
4-Chloroaniline	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	--	0.3 J	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylnaphthalene	--	--	--	--	--	--	330.0 J	--	160.0 J	--	66.0 J	--	--	--
Hexachlorocyclopentadiene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitroaniline	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dimethylphthalate	--	--	--	--	--	--	--	--	26.0 J	--	--	--	--	--

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX A
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Acenaphthylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,6-Dinitrotoluene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
3-Nitroaniline	--	--	--	--	--	--	--	--	270 0 J	--	--	--	--	--
Acenaphthalene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitrophenol	--	--	--	--	--	--	--	--	200 0 J	--	78 0 J	29 0 J	150 0 J	--
Dibenzofuran	--	--	--	--	--	--	--	--	--	--	--	21 0 J	--	--
Diethylphthalate	--	0 7 J	2 0 J	--	--	--	--	--	--	--	--	--	--	--
4-Chlorophenyl phenylether	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methoxychlor	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endrin ketone	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Alpha-chlordane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gamma-chlordane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,4'-DDE	--	--	--	--	--	--	54 9 J	52 1 J	11 3 J	64 6 J	--	--	--	9 8 J
4,4'-DDD	--	--	--	--	--	--	42 9 J	276 5 J	29 9 J	168 4 J	--	--	--	--
4,4'-DDT	--	--	--	--	--	--	33 3 J	74 9 J	17 0 J	24 4 J	--	--	--	25 9 J
Aroclor 1016	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1221	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1232	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX A
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Aroclor 1242	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1260	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aluminum	110 0 B	210 0	260 0	149 0	140 0 B	720 0	51000 0	5600 0	6400 0	6500 0	8800 0	4900 0	770 0	5900 0
Antimony	--	--	--	--	--	--	--	--	0 7 B	--	--	--	--	1 4 B
Arsenic	--	--	--	--	--	3 0 B	4 8	7 6 B	5 1	4 6	3 6	2 7	2 9 B	4 9
Barium	21 0 B	79 0 B	14 0 B	23 0 B	21 0 B	28 0 B	520 0	144 0	83 0	75 0	220 0	75 0	450 0	122 0
Beryllium	--	--	--	--	--	--	7 3	0 4	0 9 B	0 5 B	1 6	0 4 B	--	0 5 B
Cadmium	--	--	--	--	--	--	0 7 B	0 7	1 3	1 0 B	18 0	0 7 B	--	1 1
Calcium	8900 0	87000 0	13500 0	20000 0	19000 0	11000 0	236000 0	104000 0	107000 0	47000 0	110000 0	66000 0	340000 0	14000 0
Chromium	--	--	--	--	--	--	33 0	21 0	98 0	21 0	710 0	21 0	5 0 B	85 0
Cobalt	--	--	--	--	--	--	3 9 B	2 3 B	4 2 B	4 7 B	15 0	3 8 B	--	3 8 B
Copper	--	--	--	--	--	--	16 0	24 0	49 0	23 0	52 0	13 0	3 8 B	54 0
Iron	--	--	150 0	56 0 B	--	1100 0	16900 0	21000 0	4000 0	17000 0	25000 0	14000 0	30000 0	23000 0
Lead	23 0	36 0	3 0 B	6 0	13 0	38 0	20 0	76 0	128 0	69 0	110 0	40 0	--	132 00
Magnesium	3400 0 B	35000 0	5000 0 B	13000 0	3300 0 B	4500 0 B	24000 0	10500 0	27000 0	23000 0	23000 0	30000 0	40000 0	7400 0
Manganese	4 7 B	110 0	11 0 B	27 0	3 9 B	40 0	5100 0	900 0	4500 0	400 0	1100 0	1800 0	260 0	1800 0
Mercury	1 3	1 1	1 3	1 3	1 3	1 2	--	--	0 2	0 1	0 2	0 3	--	0 1
Nickel	--	8 9 B	7 8 B	7 7 B	--	9 4 B	11 0	11 0 B	17 0	14 0 B	69 0	9 6	11 0 B	31 0

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX A
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Potassium	1400 0 B	7300 0	2500 0 B	6600 0	2600 0 B	3700 0 B	3100 0	680 0	1300 0	820 0 B	600 0 B	860 0 B	--	880 0
Selenium	--	--	--	--	--	--	4 6	--	--	--	--	--	--	--
Silver	--	--	--	--	--	--	2 0 B	--	--	--	2 8	--	--	--
Sodium	105000 0	59000 0	107000 0	121000 0	94000 0	96000 0	1600 0	440 0	660 0	960 0	480 0 B	580 0 B	000 B	240 0 B
Thallium	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tin	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	--	--	--	--	--	--	4 0	200 0	111 0	21 0	170 0	38 0	41 0	100 0
Zinc	--	16 0 B	--	--	--	--	14 0	500 0	156 0	160 0	160 0	77 0	41 0	--
Cyanide	--	--	--	--	--	--	1 0	--	--	--	11 7	--	4 2	--
Sulfide	--	170000 0	--	--	--	18000 0	--	--	--	--	--	--	--	--
Sulfate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH (pH Units)	8 4	7 5	8 3	8 1	9 1	0 5	NT	NT	NT	NT	NT	NT	NT	NT
Conductivity (umhos/cm)	481 0	849 0	507 0	688 0	583 0	477 0	NT	NT	NT	NT	NT	NT	NT	NT
Temperature (°F)	53 2	52 5	53 7	53 6	53 0	50 7	NT	NT	NT	NT	NT	NT	NT	NT

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX A
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Notes: ¹ Units for groundwater are ug/l. ² Units for sediment/soil are ug/kg for organic parameters and mg/kg for inorganic parameters. "--" Means not detected. NT Not Tested R Rejected J Value is estimated D Value is from a dilution analysis B Compound detected in laboratory blank Results are from the CERCLA Screening Site Inspection Report, IEPA, Undated														

ORGANIC DATA QUALIFIERS

- U - Indicates compound was analyzed for but not detected.
- J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.
- C - This flag applies to pesticide results where the identification has been confirmed by GC/MS.
- B - This flag is used when the analyte is found in the associated blank as well as in the sample.
- E - This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis. This flag will not apply to pesticide/PCB's analyzed by GC/EC methods.
- D - This flag identifies all compounds identified in an analysis at a secondary dilution factor.
- A - This flag indicates that a TIC is a suspected aldol-condensation product.
- X - Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the Sample Data Summary Package and the Case Narrative.

INORGANIC DATA QUALIFIERS

C (Concentration) Qualifier:

- B - Indicates the reported value is less than the Contract Required Detection Limit (CRDL) but greater than the Instrument Detection Limit (IDL).
- U - Indicates compound was analyzed for but not detected.

Q Qualifier:

- E - The reported value is estimated because of the presence of interference.
- M - Duplicate injection precision not met.
- N - Spiked sample recovery not within control limits.
- S - The reported value was determined by the Method of Standard Additions (MSA).
- W - Post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while the sample absorbance is less than 50% of spike absorbance.
- * - Duplicate analysis not within control limits.
- + - Correlation coefficient for the MSA is less than 0.995.

M (Method) Qualifier Enter:

- "P" for ICP
- "A" for Flame AA
- "F" for Furnace AA
- "CV" for Manual Cold Vapor AA
- "AV" for Automated Cold Vapor AA
- "AS" for Semi-Automated Spectrophotometric
- "C" for Manual Spectrophotometric
- "T" for Titrimetric
- "NR" if the analyte is not required to be analyzed.



August 22, 1989

Mr. Timothy J. Murphy
Environmental Protection Specialist
Pre-Remedial Program Sub-Unit
State Site Management Unit
Remedial Project Management Section
Division of Land Pollution Control
Illinois Environmental Protection Agency
2200 Churchill Road
Springfield, Illinois 62794-9276

RE: Interlake Property Site Inspection

Dear Mr. Murphy:

Attached is a copy of the laboratory analysis results from the sampling done on July 18 - 20, 1989 at the Interlake Property.

Should you have any questions, please do not hesitate to call (312) 646-3099.

Very Truly Yours,
Waste Management of Illinois, Inc.

Kurt B. Thaus
Environmental Engineer
Midwest Region

cc: John McDonnell
Bert Maline
Ann Straw
File: CAP CERCLIS/SARA

↑
FOR LAB ANALYSIS RESULTS LOOK AT
FILE: "CAP INTERLAKE MONITORING RECORDS";
LETTER FROM FRANK JACKE TO JOHN McDONNELL
DATED 16-AUG-1989 06:53 pm CDT

WMI Environmental Monitoring
Laboratories, Inc.
2100 Cleanwater Drive
Geneva, Illinois 60134
312/208-3100



A Waste Management Company

Date: 16-Aug-1989 06:53pm CDT

TO: JOHN MCDONNELL

(PAPER MAIL)

From: Frank Jarke *Frank Jarke*

(JARKE)

Dept: Quality Programs

Subject: CID Report: 89-10630

Please find enclosed the current Client Reports, Field Forms and Chain-Of-Custodys for the recently completed event at CID Landfill.

The data has been thoroughly reviewed and compared to historical data. We have tried to provide a report that is complete and of the highest quality. Please take a moment to review the enclosed report to insure that it meets your expectations.

EML is now providing an Event Summary Report with our standard Client Report package. I think you will find this report as usefull as I do in reviewing the data from each event. If you have any questions or comments about this new report please let us know.

If you have any questions, don't hesitate to call the EML Customer Operations Coordinator at 312/208-3120.



WMI ENVIRONMENTAL MONITORING LABORATORIES, INC.

EVENT SUMMARY REPORT

August 16, 1989

6:05 PM

Site Id : 250
Site Name : CID Landfill
Site Type : Disposal Facility
Site Address: 138th and Calumet Expressway
Calumet City IL 60409

ENS Number : 89-10630
MPS Number : 250892
Rev Number : 00
Sample Type: WELL
Report Due : 19-Aug-1989

EML-Results

Analyte	Units	250-01PB 19-Jul-1989	250-SS01D 19-Jul-1989	250-SS02D 19-Jul-1989	250-ST01D 19-Jul-1989	250-ST02D 19-Jul-1989	250-ST03D 20-Jul-1989
FDWDTWLS01:							
DEPTH TO WATER FROM LAND SURFACE	FT	NA	34.93	23.07	31.94	16.59	20.39
FDMGWELWDT:							
GROUNDWATER ELEV.	FT MSL	NA	NA	NA	NA	NA	NA
WELL DEPTH TOTAL	FT	NA	111.06	91.26	105.49	57.09	96.12
VOMSA001:							
1,1,1-TRICHLOROETHANE	UG/L	ND	ND	ND	ND	ND	ND
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	ND	ND	ND	ND
1,1,2-TRICHLOROETHANE	UG/L	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHANE	UG/L	ND	ND	ND	ND	ND	ND
1,1-DICHLOROETHANE	UG/L	ND	ND	ND	ND	ND	ND
1,2-DICHLOROBENZENE	UG/L	ND	ND	ND	ND	ND	ND
1,2-DICHLOROETHANE	UG/L	ND	ND	ND	ND	ND	ND
1,2-DICHLOROPROPANE	UG/L	ND	ND	ND	ND	ND	ND
1,3-DICHLOROBENZENE	UG/L	ND	ND	ND	ND	ND	ND
1,4-DICHLOROBENZENE	UG/L	ND	ND	ND	ND	ND	ND
2-CHLOROETHYL VINYL ETHER	UG/L	NA	NA	NA	NA	NA	NA
BENZENE	UG/L	ND	ND	ND	ND	ND	ND
BROMODICHLOROMETHANE	UG/L	ND	ND	ND	ND	ND	ND
BROMOFORM	UG/L	ND	ND	ND	ND	ND	ND
BROMOMETHANE	UG/L	ND	ND	ND	ND	ND	ND
CARBON TETRACHLORIDE	UG/L	ND	ND	ND	ND	ND	ND
CHLOROBENZENE	UG/L	ND	ND	ND	ND	ND	ND
CHLOROETHANE	UG/L	ND	ND	ND	ND	ND	ND
CHLOROFORM	UG/L	ND	ND	ND	ND	ND	ND
CHLOROMETHANE	UG/L	ND	ND	ND	ND	ND	ND
CIS-1,3-DICHLOROPROPENE	UG/L	ND	ND	ND	ND	ND	ND
DIBROMOCHLOROMETHANE	UG/L	ND	ND	ND	ND	ND	ND
ETHYLBENZENE	UG/L	ND	ND	ND	ND	ND	ND
METHYLENE CHLORIDE	UG/L	ND	ND	ND	ND	ND	ND
TETRACHLOROETHENE	UG/L	ND	ND	ND	ND	ND	ND
TOLUENE	UG/L	ND	ND	ND	ND	ND	ND
TRANS-1,2-DICHLOROETHENE	UG/L	ND	ND	ND	ND	ND	ND
TRANS-1,3-DICHLOROPROPENE	UG/L	ND	ND	ND	ND	ND	ND
TRICHLOROETHANE	UG/L	ND	ND	ND	ND	ND	ND



WMI ENVIRONMENTAL MONITORING LABORATORIES, INC.

EVENT SUMMARY REPORT

August 16, 1989

6:05 PM

Site Id : 250
Site Name : CID Landfill
Site Type : Disposal Facility
Site Address: 138th and Calumet Expressway
Calumet City IL 60409

ENS Number : 89-10630
MPS Number : 250892
Rev Number : 00
Sample Type: WELL
Report Due : 19-Aug-1989

EML-Results

Analyte	Units	250-01PB 19-Jul-1989	250-SS01D 19-Jul-1989	250-SS02D 19-Jul-1989	250-ST01D 19-Jul-1989	250-ST02D 19-Jul-1989	250-ST03D 20-Jul-1989
TRICHLOROFLUOROMETHANE	UG/L	ND	ND	ND	ND	ND	ND
VINYL CHLORIDE	UG/L	ND	ND	ND	ND	ND	ND
VOMSA00101:							
1,1,1-TRICHLOROETHANE	UG/L		ND				
1,1,2,2-TETRACHLOROETHANE	UG/L		ND				
1,1,2-TRICHLOROETHANE	UG/L		ND				
1,1-DICHLOROETHANE	UG/L		ND				
1,1-DICHLOROETHENE	UG/L		ND				
1,2-DICHLOROBENZENE	UG/L		ND				
1,2-DICHLOROETHANE	UG/L		ND				
1,2-DICHLOROPROPANE	UG/L		ND				
1,3-DICHLOROBENZENE	UG/L		ND				
1,4-DICHLOROBENZENE	UG/L		ND				
2-CHLOROETHYL VINYL ETHER	UG/L		NA				
BENZENE	UG/L		ND				
BROMODICHLOROMETHANE	UG/L		ND				
BROMOFORM	UG/L		ND				
BROMOMETHANE	UG/L		ND				
CARBON TETRACHLORIDE	UG/L		ND				
CHLOROBENZENE	UG/L		ND				
CHLOROETHANE	UG/L		ND				
CHLOROFORM	UG/L		ND				
CHLOROMETHANE	UG/L		ND				
CIS-1,3-DICHLOROPROPENE	UG/L		ND				
DIBROMOCHLOROMETHANE	UG/L		ND				
ETHYLBENZENE	UG/L		ND				
METHYLENE CHLORIDE	UG/L		ND				
TETRACHLOROETHENE	UG/L		ND				
TOLUENE	UG/L		ND				
TRANS-1,2-DICHLOROETHENE	UG/L		ND				
TRANS-1,3-DICHLOROPROPENE	UG/L		ND				
TRICHLOROETHENE	UG/L		ND				
TRICHLOROFLUOROMETHANE	UG/L		ND				
VINYL CHLORIDE	UG/L		ND				

NA = Not Analyzed

ND = Not Detected



10674

6:05 PM

1 209000 5N3

HPS Number :

REV. NATHAN A. LOR

ENS Number : 89-10630
HPS Number : 250892
Rev Number : 00
Sample Type: WELL
Report Due : 19-Aug-1989

Amalye

250-57040
20-541-1989

DEPTH TO WATER FROM LAND SURFACE

40.35

! 10072M90

GROUNDWATER
WELL DEPTH

TSN 14

MA
100.94

! 10144580A

[illegible]



WHI ENVIRONMENTAL MONITORING LABORATORIES, INC.

EVENT SUMMARY REPORT

August 16, 1989

6:05 PM

Site Id : 250
Site Name : CID Landfill
Site Type : Disposal Facility
Site Address: 138th and Calumet Expressway
Calumet City IL 60409

ENS Number : 89-10630
MPS Number : 250892
Rev Number : 00
Sample Type: WELL
Report Due : 19-Aug-1989

EHL-Results

Analyte	Units	250-ST04D 20-Jul-1989					
TRICHLOROFLUOROMETHANE	UG/L	ND					
VINYL CHLORIDE	UG/L	ND					
VOMSAAA301:							
1,1,1-TRICHLOROETHANE	UG/L						
1,1,2,2-TETRACHLOROETHANE	UG/L						
1,1,2-TRICHLOROETHANE	UG/L						
1,1-DICHLOROETHANE	UG/L						
1,1-DICHLOROETHENE	UG/L						
1,2-DICHLOROBENZENE	UG/L						
1,2-DICHLOROETHANE	UG/L						
1,2-DICHLOROPROPANE	UG/L						
1,3-DICHLOROBENZENE	UG/L						
1,4-DICHLOROBENZENE	UG/L						
2-CHLOROETHYL VINYL ETHER	UG/L						
BENZENE	UG/L						
BROMODICHLOROMETHANE	UG/L						
BROMOFORM	UG/L						
BROMOMETHANE	UG/L						
CARBON TETRACHLORIDE	UG/L						
CHLOROBENZENE	UG/L						
CHLOROETHANE	UG/L						
CHLOROFORM	UG/L						
CHLOROMETHANE	UG/L						
CIS-1,3-DICHLOROPROPENE	UG/L						
DIBROMOCHLOROMETHANE	UG/L						
ETHYLBENZENE	UG/L						
METHYLENE CHLORIDE	UG/L						
TETRACHLOROETHENE	UG/L						
TOLUENE	UG/L						
TRANS-1,2-DICHLOROETHENE	UG/L						
TRANS-1,3-DICHLOROPROPENE	UG/L						
TRICHLOROETHENE	UG/L						
TRICHLOROFLUOROMETHANE	UG/L						
VINYL CHLORIDE	UG/L						

NA = Not Analysed
ND = Not Detected



Hydrology Division

2204 Griffith Drive

Champaign, Illinois 61820-749

Telephone (217) 333-3800

Telefax (217) 333-054

RECEIVED

SEP 5 - 1991

CID RECYCLING & DISPOSAL FACILITY

September 3, 1991

Mr. John McDonnell, P.E.
Waste Management of Illinois, Inc.
P.O. Box 1309
Calumet City, Illinois 60409

Dear Mr. McDonnell:

I am sending you the results of our organic analyses from the July 12, 1991, sampling of ground water from the four shallow wells (ST-1S, ST-2S, ST-3S, and ST-4S) at the Interlake site. Please note that a fifth analysis, identified as ST-6S, is actually a field duplicate of ST-1S.

The inorganic analyses have not been completed. The lab has had a delay in analyzing for the metals. Fortunately, the holding time on metals is 6 months once the sample is acidified with nitric acid. The full inorganic analyses will be sent to you as soon as I receive them.

Should you have any questions or wish to discuss the attached information, please call.

Sincerely,

Stuart J. Cravens
Associate Hydrologist
(217) 333-7951



A Division of the

Illinois Department of Energy and Natural Resources

DA Daily Analytical Laboratories

1621 W. Candletree Drive Peoria, Illinois 61614
Tel. (309) 692-5252 (800) 752-6651

Illinois State Water Survey
Research Center - Room #224
2204 Griffith Drive
Champaign, IL 61820
Attn: Mr. Stu Cravens

Date Received: 07/15/91
Date of Report: 08/21/91
Work Order: 91-07-399
Job Number:
of Samples: 5

Work ID: Ill. State Water Survey Wells
P O # : RU 62313 ER

Test	Units	Well ST-1S	Well ST-2S	Well ST-3S	Well ST-4S
		07/12/91	07/12/91	07/12/91	07/12/91
Total Organic Carbon					
mg/l		74	4.8	210	53

Test	Units	Well ST-6S
		07/12/91
Total Organic Carbon		
mg/l		72

B - volatile method blank contained 21 ug/l methylene chloride

Certified By:

Patricia Schultz-Benker
Patricia Schultz-Benker
Senior Organic Chemist

IEPA Registry No. 100219

Daily Analytical is an IEPA certified laboratory.
All analyses are performed by methodology
acceptable to U.S. EPA and IEPA.

DA Daily Analytical Laboratories

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Received: 07/15/91

DAILY LABS REPORT
Results by Sample

Work Order # 91-07-399

SAMPLE ID Well ST-1S FRACTION 01A Date & Time Collected 07/12/91

SEMIVOLATILE ORGANIC ANALYSIS

COMPOUNDS	Class II Std	CONC.	DETECTION LIMIT	UNITS
N-Nitrosodimethylamine**		nd	△0	ug/l
→ Phenol	100 ppb	150	△0	ug/l
bis(2-Chloroethyl)ether		nd	△0	ug/l
2-Chlorophenol		nd	△0	ug/l
1,3-Dichlorobenzene		nd	△0	ug/l
1,4-Dichlorobenzene		nd	△0	ug/l
Benzyl alcohol*		nd	△0	ug/l
1,2-Dichlorobenzene		nd	△0	ug/l
2-Methylphenol*		nd	△0	ug/l
bis(2-Chloroisopropyl)ether		nd	△0	ug/l
4-Methylphenol*		nd	△0	ug/l
N-Nitrosodipropylamine		nd	△0	ug/l
Hexachloroethane		nd	△0	ug/l
Nitrobenzene		nd	△0	ug/l
Isophorone		nd	△0	ug/l
2-Nitrophenol		nd	△0	ug/l
2,4-Dimethylphenol		nd	△0	ug/l
→ Benzoic acid*	—	52	△0	ug/l
bis(2-Chloroethoxy)methane		nd	△0	ug/l
2,4-Dichlorophenol		nd	△0	ug/l
1,2,4-Trichlorobenzene		nd	△0	ug/l
→ Naphthalene	—	10	△0	ug/l
4-Chloroaniline*		nd	△0	ug/l
Hexachlorobutadiene		nd	△0	ug/l
4-Chloro-3-methylphenol		nd	△0	ug/l
→ 2-Methylnaphthalene*	—	12	△0	ug/l
Hexachlorocyclopentadiene		nd	△0	ug/l
2,4,6-Trichlorophenol		nd	△0	ug/l
2,4,5-Trichlorophenol*		nd	△0	ug/l
2-Chloronaphthalene		nd	△0	ug/l
2-Nitroaniline*		nd	△0	ug/l
Dimethylphthalate		nd	△0	ug/l
Acenaphthylene		nd	△0	ug/l
2,6-Dinitrotoluene		nd	△0	ug/l

nd = compound not detected
B = compound present in method blank
J = compound present below detection limit

* = non-TT0 compound
** = non-IEPA target compound

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DAILY LABS
Results by Sample

REPORT

Work Order # 91-07-399

SAMPLE ID Well ST-1S

FRACTION 01A

Date & Time Collected 07/12/91

SEMIVOLATILE ORGANIC ANALYSIS (cont.)

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
3-Nitroaniline*	nd	<50	ug/l
Acenaphthene	nd	<50	ug/l
2,4-Dinitrophenol	nd	<50	ug/l
4-Nitrophenol	nd	<50	ug/l
Dibenzofuran*	nd	<50	ug/l
2,4-Dinitrotoluene	nd	<50	ug/l
Diethylphthalate	nd	<50	ug/l
4-Chlorophenyl-phenylether	nd	<50	ug/l
Fluorene	nd	<50	ug/l
4-Nitroaniline*	nd	<50	ug/l
4,6-Dinitro-2-methylphenol	nd	<50	ug/l
1,2-Diphenylhydrazine**	nd	<50	ug/l
N-Nitrosodiphenylamine	nd	<50	ug/l
4-Bromophenyl-phenylether	nd	<50	ug/l
Hexachlorobenzene	nd	<50	ug/l
Pentachlorophenol	nd	<50	ug/l
Phenanthrene	nd	<50	ug/l
Anthracene	nd	<50	ug/l
Di-n-butylphthalate	nd	<50	ug/l
Fluoranthene	nd	<50	ug/l
Pyrene	nd	<50	ug/l
Benzidine**	nd	<50	ug/l
Butylbenzylphthalate	nd	<50	ug/l
3,3'-Dichlorobenzidine	nd	<50	ug/l
Benzo(a)anthracene	nd	<50	ug/l
Chrysene	nd	<50	ug/l
bis(2-Ethylhexyl)phthalate	nd	<50	ug/l
Di-n-octylphthalate	nd	<50	ug/l
Benzo(b)fluoranthene	nd	<50	ug/l
Benzo(k)fluoranthene	nd	<50	ug/l
Benzo(a)pyrene	nd	<50	ug/l
Indeno(1,2,3-cd)pyrene	nd	<50	ug/l
Dibenz(a,h)anthracene	nd	<50	ug/l
Benzo(g,h,i)perylene	nd	<50	ug/l

nd = compound not detected
B = compound present in method blank
J = compound present below detection limit

* = non-TTO compound
** = non-IEPA target compound

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DAILY LABS REPORT
Results by Sample

Work Order # 91-07-209

SAMPLE ID Well ST-15

FRACTION 01A

Date & Time Collected 07/12/91

VOLATILE ORGANIC ANALYSIS

COMPOUNDS	51d	CONC.	DETECTION LIMIT	UNITS
Chloromethane	nd		100	ug/l
Vinyl Chloride	nd		100	ug/l
Bromomethane	nd		100	ug/l
Chloroethane	nd		100	ug/l
Trichlorofluoromethane**	nd		100	ug/l
Acrolein **	nd		100	ug/l
1,1-Dichloroethene	nd		100	ug/l
→ Acetone*	230		100	ug/l
Carbon Disulfide*	nd		100	ug/l
Methylene Chloride	4		100	ug/l
trans-1,2-Dichloroethene	nd		100	ug/l
Acrylonitrile **	nd		100	ug/l
1,1-Dichloroethane	nd		100	ug/l
Vinyl Acetate*	nd		100	ug/l
2-Butanone (MEK)*	nd		100	ug/l
cis-1,2-Dichloroethene	nd		100	ug/l
Chloroform	nd		100	ug/l
1,1,1-Trichloroethane	nd		100	ug/l
Carbon Tetrachloride	nd		100	ug/l
Benzene	nd		100	ug/l
1,2-Dichloroethane	nd		100	ug/l
Trichloroethene	nd		100	ug/l
1,2-Dichloropropane	nd		100	ug/l
Bromodichloromethane	nd		100	ug/l
4-Methyl-2-Pentanone (MIBK)*	nd		100	ug/l
cis-1,3-Dichloropropene	nd		100	ug/l
Toluene	nd		100	ug/l
trans-1,3-Dichloropropene	nd		100	ug/l
1,1,2-Trichloroethane	nd		100	ug/l
2-Hexanone (MEK)*	nd		100	ug/l
Tetrachloroethene	nd		100	ug/l
Dibromochloromethane	nd		100	ug/l
Chlorobenzene	nd		100	ug/l
Ethylbenzene	nd		100	ug/l
1,1,1,2-Tetrachloroethane**	nd		100	ug/l
Total Xylenes*	10 ppm	9 ppm	100	ug/l
Styrene*	nd		100	ug/l
Bromoform	nd		100	ug/l
1,1,2,2-Tetrachloroethane	nd		100	ug/l
1,3-Dichlorobenzene**	nd		100	ug/l
1,4-Dichlorobenzene**	nd		100	ug/l
1,2-Dichlorobenzene**	nd		100	ug/l

nd = compound not detected
B = compound present in method blank
J = compound present below detection limit

* = non-TTO compound
** = non-IEPA target compound

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DAILY LABS

REPORT
Results by Sample

Work Order # 91-07-399

SAMPLE ID Well ST-2S

FRACTION 02A

Date & Time Collected 07/12/91

SEMIVOLATILE ORGANIC ANALYSIS

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
N-Nitrosodimethylamine**	nd	<10	ug/l
Phenol	nd	<10	ug/l
bis(2-Chloroethyl)ether	nd	<10	ug/l
2-Chlorophenol	nd	<10	ug/l
1,3-Dichlorobenzene	nd	<10	ug/l
1,4-Dichlorobenzene	nd	<10	ug/l
Benzyl alcohol*	nd	<10	ug/l
1,2-Dichlorobenzene	nd	<10	ug/l
2-Methylphenol*	nd	<10	ug/l
bis(2-Chloroisopropyl)ether	nd	<10	ug/l
4-Methylphenol*	nd	<10	ug/l
N-Nitrosodipropylamine	nd	<10	ug/l
Hexachloroethane	nd	<10	ug/l
Nitrobenzene	nd	<10	ug/l
Isophorone	nd	<10	ug/l
2-Nitrophenol	nd	<50	ug/l
2,4-Dimethylphenol	nd	<10	ug/l
Benzoic acid*	nd	<50	ug/l
bis(2-Chloroethoxy)methane	nd	<10	ug/l
2,4-Dichlorophenol	nd	<10	ug/l
1,2,4-Trichlorobenzene	nd	<10	ug/l
Naphthalene	nd	<10	ug/l
4-Chloroaniline*	nd	<10	ug/l
Hexachlorobutadiene	nd	<10	ug/l
4-Chloro-3-methylphenol	nd	<10	ug/l
2-Methylnaphthalene*	nd	<10	ug/l
Hexachlorocyclopentadiene	nd	<10	ug/l
2,4,6-Trichlorophenol	nd	<10	ug/l
2,4,5-Trichlorophenol*	nd	<50	ug/l
2-Chloronaphthalene	nd	<10	ug/l
2-Nitroaniline*	nd	<50	ug/l
Dimethylphthalate	nd	<10	ug/l
Acenaphthylene	nd	<10	ug/l
2,6-Dinitrotoluene	nd	<10	ug/l

nd = compound not detected
B = compound present in method blank
J = compound present below detection limit

* = non-TTO compound
** = non-IEPA target compound

DA Daily Analytical Laboratories

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Received: 07/15/91

DAILY LABS
Results by Sample

REPORT
Work Order # 91-07-399

SAMPLE ID Well ST-25 FRACTION 02A Date & Time Collected 07/12/91

SEMIVOLATILE ORGANIC ANALYSIS (cont.)

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
3-Nitroaniline*	nd	50	ug/l
Acenaphthene	nd	50	ug/l
2,4-Dinitrophenol	nd	50	ug/l
4-Nitrophenol	nd	50	ug/l
Dibenzofuran*	nd	50	ug/l
2,4-Dinitrotoluene	nd	50	ug/l
Diethylphthalate	nd	50	ug/l
4-Chlorophenyl-phenylether	nd	50	ug/l
Fluorene	nd	50	ug/l
4-Nitroaniline*	nd	50	ug/l
4,6-Dinitro-2-methylphenol	nd	50	ug/l
1,2-Diphenylhydrazine**	nd	50	ug/l
N-Nitrosodiphenylamine	nd	50	ug/l
4-Bromophenyl-phenylether	nd	50	ug/l
Hexachlorobenzene	nd	50	ug/l
Pentachlorophenol	nd	50	ug/l
Phenanthrene	nd	50	ug/l
Anthracene	nd	50	ug/l
Di-n-butylphthalate	nd	50	ug/l
Fluoranthene	nd	50	ug/l
Pyrene	nd	50	ug/l
Benzidine**	nd	50	ug/l
Butylbenzylphthalate	nd	50	ug/l
3,3'-Dichlorobenzidine	nd	50	ug/l
Benzo(a)anthracene	nd	50	ug/l
Chrysene	nd	50	ug/l
bis(2-Ethylhexyl)phthalate	nd	50	ug/l
Di-n-octylphthalate	nd	50	ug/l
Benzo(b)fluoranthene	nd	50	ug/l
Benzo(k)fluoranthene	nd	50	ug/l
Benzo(a)pyrene	nd	50	ug/l
Indeno(1,2,3-cd)pyrene	nd	50	ug/l
Dibenz(a,h)anthracene	nd	50	ug/l
Benzo(g,h,i)perylene	nd	50	ug/l

nd = compound not detected
B = compound present in method blank
J = compound present below detection limit

* = non-TTO compound
** = non-IEPA target compound

DA Daily Analytical Laboratories

1621 W. Candletree Drive Peoria, Illinois 61614
Tel. (309) 692-5252 (800) 752-6651

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Received: 07/15/91

DAILY LABS REPORT
Results by Sample

Work Order # 91-07-399

SAMPLE ID Well ST-25

FRACTION 02A

Date & Time Collected 07/12/91

VOLATILE ORGANIC ANALYSIS

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
Chloromethane	nd	△0	ug/l
Vinyl Chloride	nd	△0	ug/l
Bromomethane	nd	△0	ug/l
Chloroethane	nd	△0	ug/l
Trichlorofluoromethane**	nd	△0	ug/l
Acrolein **	nd	△0	ug/l
1,1-Dichloroethene	nd	△0	ug/l
→ Acetone*	18	△0	ug/l
Carbon Disulfide*	nd	△0	ug/l
Methylene Chloride	15 B	△0	ug/l
trans-1,2-Dichloroethene	nd	△0	ug/l
Acrylonitrile **	nd	△0	ug/l
1,1-Dichloroethane	nd	△0	ug/l
Vinyl Acetate*	nd	△0	ug/l
2-Butanone (MEK)*	nd	△0	ug/l
cis-1,2-Dichloroethene	nd	△0	ug/l
Chloroform	nd	△0	ug/l
1,1,1-Trichloroethane	nd	△0	ug/l
Carbon Tetrachloride	nd	△0	ug/l
Benzene	nd	△0	ug/l
1,2-Dichloroethane	nd	△0	ug/l
Trichloroethene	nd	△0	ug/l
1,2-Dichloropropane	nd	△0	ug/l
Bromodichloromethane	nd	△0	ug/l
4-Methyl-2-Pentanone (MIBK)*	5 J	△0	ug/l
cis-1,3-Dichloropropene	nd	△0	ug/l
Toluene	nd	△0	ug/l
trans-1,3-Dichloropropene	nd	△0	ug/l
1,1,2-Trichloroethane	nd	△0	ug/l
2-Hexanone (MEK)*	nd	△0	ug/l
Tetrachloroethene	nd	△0	ug/l
Dibromochloromethane	nd	△0	ug/l
Chlorobenzene	nd	△0	ug/l
Ethylbenzene	nd	△0	ug/l
1,1,1,2-Tetrachloroethane**	nd	△0	ug/l
Total Xylenes*	nd	△0	ug/l
Styrene*	nd	△0	ug/l
Bromoform	nd	△0	ug/l
1,1,2,2-Tetrachloroethane	nd	△0	ug/l
1,3-Dichlorobenzene**	nd	△0	ug/l
1,4-Dichlorobenzene**	nd	△0	ug/l
1,2-Dichlorobenzene**	nd	△0	ug/l

nd = compound not detected
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J = compound present below detection limit

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** = non-IEPA target compound

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SEMIVOLATILE ORGANIC ANALYSIS

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
N-Nitrosodimethylamine**	nd	△0	ug/l
Phenol	nd	△0	ug/l
bis(2-Chloroethyl)ether	nd	△0	ug/l
2-Chlorophenol	nd	△0	ug/l
1,3-Dichlorobenzene	nd	△0	ug/l
1,4-Dichlorobenzene	nd	△0	ug/l
Benzyl alcohol*	nd	△0	ug/l
1,2-Dichlorobenzene	nd	△0	ug/l
2-Methylphenol*	nd	△0	ug/l
bis(2-Chloroisopropyl)ether	nd	△0	ug/l
4-Methylphenol*	nd	△0	ug/l
N-Nitrosodipropylamine	nd	△0	ug/l
Hexachloroethane	nd	△0	ug/l
Nitrobenzene	nd	△0	ug/l
Isophorone	nd	△0	ug/l
2-Nitrophenol	nd	△50	ug/l
2,4-Dimethylphenol	nd	△0	ug/l
Benzoic acid*	nd	△50	ug/l
bis(2-Chloroethoxy)methane	nd	△0	ug/l
2,4-Dichlorophenol	nd	△0	ug/l
1,2,4-Trichlorobenzene	nd	△0	ug/l
Naphthalene	nd	△0	ug/l
4-Chloroaniline*	nd	△0	ug/l
Hexachlorobutadiene	nd	△0	ug/l
4-Chloro-3-methylphenol	nd	△0	ug/l
2-Methylnaphthalene*	nd	△0	ug/l
Hexachlorocyclopentadiene	nd	△0	ug/l
2,4,6-Trichlorophenol	nd	△0	ug/l
2,4,5-Trichlorophenol*	nd	△50	ug/l
2-Chloronaphthalene	nd	△0	ug/l
2-Nitroaniline*	nd	△50	ug/l
Dimethylphthalate	nd	△0	ug/l
Acenaphthylene	nd	△0	ug/l
2,6-Dinitrotoluene	nd	△0	ug/l

nd = compound not detected
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J = compound present below detection limit

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SAMPLE ID Well ST-35

FRACTION 03A

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SEMIVOLATILE ORGANIC ANALYSIS (cont.)

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
3-Nitroaniline*	nd	<50	ug/l
Acenaphthene	nd	<10	ug/l
2,4-Dinitrophenol	nd	<50	ug/l
4-Nitrophenol	nd	<50	ug/l
Dibenzofuran*	nd	<10	ug/l
2,4-Dinitrotoluene	nd	<10	ug/l
Diethylphthalate	nd	<10	ug/l
4-Chlorophenyl-phenylether	nd	<10	ug/l
Fluorene	nd	<10	ug/l
4-Nitroaniline*	nd	<50	ug/l
4,6-Dinitro-2-methylphenol	nd	<50	ug/l
1,2-Diphenylhydrazine**	nd	<10	ug/l
N-Nitrosodiphenylamine	nd	<10	ug/l
4-Bromophenyl-phenylether	nd	<10	ug/l
Hexachlorobenzene	nd	<10	ug/l
Pentachlorophenol	nd	<50	ug/l
Phenanthrene	nd	<10	ug/l
Anthracene	nd	<10	ug/l
Di-n-butylphthalate	nd	<10	ug/l
Fluoranthene	nd	<10	ug/l
Pyrene	nd	<10	ug/l
Benzidine**	nd	<80	ug/l
Butylbenzylphthalate	nd	<10	ug/l
3,3'-Dichlorobenzidine	nd	<20	ug/l
Benzo(a)anthracene	nd	<10	ug/l
Chrysene	nd	<10	ug/l
bis(2-Ethylhexyl)phthalate	nd	<10	ug/l
Di-n-octylphthalate	nd	<10	ug/l
Benzo(b)fluoranthene	nd	<10	ug/l
Benzo(k)fluoranthene	nd	<10	ug/l
Benzo(a)pyrene	nd	<10	ug/l
Indeno(1,2,3-cd)pyrene	nd	<10	ug/l
Dibenz(a,h)anthracene	nd	<10	ug/l
Benzo(g,h,i)perylene	nd	<10	ug/l

nd - compound not detected
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SAMPLE ID Well ST-3S FRACTION 03A Date & Time Collected 07/12/91

VOLATILE ORGANIC ANALYSIS

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
Chloromethane	nd	△△0	ug/l
Vinyl Chloride	nd	△△0	ug/l
Bromomethane	nd	△△0	ug/l
Chloroethane	nd	△△0	ug/l
Trichlorofluoromethane**	nd	△△0	ug/l
Acrolein **	nd	△△0	ug/l
1,1-Dichloroethene	nd	△△0	ug/l
Acetone*	nd	△△0	ug/l
Carbon Disulfide*	nd	△△0	ug/l
Methylene Chloride	19	△△0	ug/l
trans-1,2-Dichloroethene	nd	△△0	ug/l
Acrylonitrile **	nd	△△0	ug/l
1,1-Dichloroethane	nd	△△0	ug/l
Vinyl Acetate*	nd	△△0	ug/l
2-Butanone (MEK)*	nd	△△0	ug/l
cis-1,2-Dichloroethene	nd	△△0	ug/l
Chloroform	nd	△△0	ug/l
1,1,1-Trichloroethane	nd	△△0	ug/l
Carbon Tetrachloride	nd	△△0	ug/l
Benzene	nd	△△0	ug/l
1,2-Dichloroethane	nd	△△0	ug/l
Trichloroethene	nd	△△0	ug/l
1,2-Dichloropropane	nd	△△0	ug/l
Bromodichloromethane	nd	△△0	ug/l
4-Methyl-2-Pentanone (MIBK)*	nd	△△0	ug/l
cis-1,3-Dichloropropene	nd	△△0	ug/l
Toluene	nd	△△0	ug/l
trans-1,3-Dichloropropene	nd	△△0	ug/l
1,1,2-Trichloroethane	nd	△△0	ug/l
2-Hexanone (MEK)*	nd	△△0	ug/l
Tetrachloroethene	nd	△△0	ug/l
Dibromochloromethane	nd	△△0	ug/l
Chlorobenzene	nd	△△0	ug/l
Ethylbenzene	nd	△△0	ug/l
1,1,1,2-Tetrachloroethane**	nd	△△0	ug/l
Total Xylenes*	nd	△△0	ug/l
Styrene*	nd	△△0	ug/l
Bromoform	nd	△△0	ug/l
1,1,2,2-Tetrachloroethane	nd	△△0	ug/l
1,3-Dichlorobenzene**	nd	△△0	ug/l
1,4-Dichlorobenzene**	nd	△△0	ug/l
1,2-Dichlorobenzene**	nd	△△0	ug/l

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nd = compound not detected
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SAMPLE ID Well ST-4S

FRACTION 04A

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SEMIVOLATILE ORGANIC ANALYSIS

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
N-Nitrosodimethylamine**	nd	<10	ug/l
Phenol	nd	<10	ug/l
bis(2-Chloroethyl)ether	nd	<10	ug/l
2-Chlorophenol	nd	<10	ug/l
1,3-Dichlorobenzene	nd	<10	ug/l
1,4-Dichlorobenzene	nd	<10	ug/l
Benzyl alcohol*	nd	<10	ug/l
1,2-Dichlorobenzene	nd	<10	ug/l
2-Methylphenol*	nd	<10	ug/l
bis(2-Chloroisopropyl)ether	nd	<10	ug/l
4-Methylphenol*	nd	<10	ug/l
N-Nitrosodipropylamine	nd	<10	ug/l
Hexachloroethane	nd	<10	ug/l
Nitrobenzene	nd	<10	ug/l
Isophorone	nd	<10	ug/l
2-Nitrophenol	nd	<50	ug/l
2,4-Dimethylphenol	nd	<10	ug/l
Benzoic acid*	nd	<50	ug/l
bis(2-Chloroethoxy)methane	nd	<10	ug/l
2,4-Dichlorophenol	nd	<10	ug/l
1,2,4-Trichlorobenzene	nd	<10	ug/l
Naphthalene	nd	<10	ug/l
4-Chloroaniline*	nd	<10	ug/l
Hexachlorobutadiene	nd	<10	ug/l
4-Chloro-3-methylphenol	nd	<10	ug/l
2-Methylnaphthalene*	nd	<10	ug/l
Hexachlorocyclopentadiene	nd	<10	ug/l
2,4,6-Trichlorophenol	nd	<10	ug/l
2,4,5-Trichlorophenol*	nd	<50	ug/l
2-Chloronaphthalene	nd	<10	ug/l
2-Nitroaniline*	nd	<50	ug/l
Dimethylphthalate	nd	<10	ug/l
Acenaphthylene	nd	<10	ug/l
2,6-Dinitrotoluene	nd	<10	ug/l

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SAMPLE ID Well ST-4S

FRACTION 04A

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SEMIVOLATILE ORGANIC ANALYSIS (cont.)

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
3-Nitroaniline*	nd	△50	ug/l
Acenaphthene	nd	△10	ug/l
2,4-Dinitrophenol	nd	△50	ug/l
4-Nitrophenol	nd	△50	ug/l
Dibenzofuran*	nd	△10	ug/l
2,4-Dinitrotoluene	nd	△10	ug/l
Diethylphthalate	nd	△10	ug/l
4-Chlorophenyl-phenylether	nd	△10	ug/l
Fluorene	nd	△10	ug/l
4-Nitroaniline*	nd	△50	ug/l
4,6-Dinitro-2-methylphenol	nd	△50	ug/l
1,2-Diphenylhydrazine**	nd	△10	ug/l
N-Nitrosodiphenylamine	nd	△10	ug/l
4-Bromophenyl-phenylether	nd	△10	ug/l
Hexachlorobenzene	nd	△10	ug/l
Pentachlorophenol	nd	△50	ug/l
Phenanthrene	nd	△10	ug/l
Anthracene	nd	△10	ug/l
Di-n-butylphthalate	nd	△10	ug/l
Fluoranthene	nd	△10	ug/l
Pyrene	nd	△10	ug/l
Benzidine**	nd	△80	ug/l
Butylbenzylphthalate	nd	△10	ug/l
3,3'-Dichlorobenzidine	nd	△10	ug/l
Benzo(a)anthracene	nd	△10	ug/l
Chrysene	nd	△10	ug/l
bis(2-Ethylhexyl)phthalate	nd	△10	ug/l
Di-n-octylphthalate	nd	△10	ug/l
Benzo(b)fluoranthene	nd	△10	ug/l
Benzo(k)fluoranthene	nd	△10	ug/l
Benzo(a)pyrene	nd	△10	ug/l
Indeno(1,2,3-cd)pyrene	nd	△10	ug/l
Dibenz(a,h)anthracene	nd	△10	ug/l
Benzo(g,h,i)perylene	nd	△10	ug/l

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SAMPLE ID Well ST-4S FRACTION 04A Date & Time Collected 07/12/91

VOLATILE ORGANIC ANALYSIS

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
Chloromethane	nd	△△	ug/l
Vinyl Chloride	nd	△△△	ug/l
Bromomethane	nd	△△△	ug/l
Chloroethane	nd	△△△	ug/l
Trichlorofluoromethane**	nd	△△△	ug/l
Acrolein **	nd	△△△	ug/l
1,1-Dichloroethene	nd	△△△	ug/l
Acetone*	nd	△△△	ug/l
Carbon Disulfide*	nd	△△△	ug/l
Methylene Chloride	16	△△△	ug/l
trans-1,2-Dichloroethene	nd	△△△	ug/l
Acrylonitrile **	nd	△△△	ug/l
1,1-Dichloroethane	nd	△△△	ug/l
Vinyl Acetate*	nd	△△△	ug/l
2-Butanone (MEK)*	nd	△△△	ug/l
cis-1,2-Dichloroethene	nd	△△△	ug/l
Chloroform	nd	△△△	ug/l
1,1,1-Trichloroethane	nd	△△△	ug/l
Carbon Tetrachloride	nd	△△△	ug/l
Benzene	nd	△△△	ug/l
1,2-Dichloroethane	nd	△△△	ug/l
Trichloroethene	nd	△△△	ug/l
1,2-Dichloropropane	nd	△△△	ug/l
Bromodichloromethane	nd	△△△	ug/l
4-Methyl-2-Pentanone (MIBK)*	nd	△△△	ug/l
cis-1,3-Dichloropropene	nd	△△△	ug/l
Toluene	nd	△△△	ug/l
trans-1,3-Dichloropropene	nd	△△△	ug/l
1,1,2-Trichloroethane	nd	△△△	ug/l
2-Hexanone (MBK)*	nd	△△△	ug/l
Tetrachloroethene	nd	△△△	ug/l
Dibromochloromethane	nd	△△△	ug/l
Chlorobenzene	nd	△△△	ug/l
Ethylbenzene	nd	△△△	ug/l
1,1,1,2-Tetrachloroethane**	nd	△△△	ug/l
Total Xylenes*	8 J	△△△	ug/l
Styrene*	nd	△△△	ug/l
Bromoform	nd	△△△	ug/l
1,1,2,2-Tetrachloroethane	nd	△△△	ug/l
1,3-Dichlorobenzene**	nd	△△△	ug/l
1,4-Dichlorobenzene**	nd	△△△	ug/l
1,2-Dichlorobenzene**	nd	△△△	ug/l

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SAMPLE ID Well ST-6S

FRACTION 05A

Date & Time Collected 07/12/91

SEMIVOLATILE ORGANIC ANALYSIS

COMPOUNDS	Class II Std	CONC.	DETECTION LIMIT	UNITS
N-Nitrosodimethylamine**		nd	△0	ug/l
Phenol	100ppb	160	△0	ug/l
bis(2-Chloroethyl)ether		nd	△0	ug/l
2-Chlorophenol		nd	△0	ug/l
1,3-Dichlorobenzene		nd	△0	ug/l
1,4-Dichlorobenzene		nd	△0	ug/l
Benzyl alcohol*		nd	△0	ug/l
1,2-Dichlorobenzene		nd	△0	ug/l
2-Methylphenol*		nd	△0	ug/l
bis(2-Chloroisopropyl)ether		nd	△0	ug/l
4-Methylphenol*		nd	△0	ug/l
N-Nitrosodipropylamine		nd	△0	ug/l
Hexachloroethane		nd	△0	ug/l
Nitrobenzene		nd	△0	ug/l
Isophorone		nd	△0	ug/l
2-Nitrophenol		nd	△0	ug/l
2,4-Dimethylphenol		nd	△0	ug/l
Benzoic acid*		56	△0	ug/l
bis(2-Chloroethoxy)methane		nd	△0	ug/l
2,4-Dichlorophenol		nd	△0	ug/l
1,2,4-Trichlorobenzene		nd	△0	ug/l
Naphthalene		7 J	△0	ug/l
4-Chloroaniline*		nd	△0	ug/l
Hexachlorobutadiene		nd	△0	ug/l
4-Chloro-3-methylphenol		nd	△0	ug/l
2-Methylnaphthalene*		9 J	△0	ug/l
Hexachlorocyclopentadiene		nd	△0	ug/l
2,4,6-Trichlorophenol		nd	△0	ug/l
2,4,5-Trichlorophenol*		nd	△0	ug/l
2-Chloronaphthalene		nd	△0	ug/l
2-Nitroaniline*		nd	△0	ug/l
Dimethylphthalate		nd	△0	ug/l
Acenaphthylene		nd	△0	ug/l
2,6-Dinitrotoluene		nd	△0	ug/l

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SAMPLE ID Well ST-6S FRACTION 05A Date & Time Collected 07/12/91

SEMIVOLATILE ORGANIC ANALYSIS (cont.)

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
3-Nitroaniline*	nd	<50	ug/l
Acenaphthene	nd	<10	ug/l
2,4-Dinitrophenol	nd	<50	ug/l
4-Nitrophenol	nd	<50	ug/l
Dibenzofuran*	nd	<10	ug/l
2,4-Dinitrotoluene	nd	<10	ug/l
Diethylphthalate	nd	<10	ug/l
4-Chlorophenyl-phenylether	nd	<10	ug/l
Fluorene	nd	<10	ug/l
4-Nitroaniline*	nd	<50	ug/l
4,6-Dinitro-2-methylphenol	nd	<50	ug/l
1,2-Diphenylhydrazine**	nd	<10	ug/l
N-Nitrosodiphenylamine	nd	<10	ug/l
4-Bromophenyl-phenylether	nd	<10	ug/l
Hexachlorobenzene	nd	<10	ug/l
Pentachlorophenol	nd	<50	ug/l
Phenanthrene	nd	<10	ug/l
Anthracene	nd	<10	ug/l
Di-n-butylphthalate	nd	<10	ug/l
Fluoranthene	nd	<10	ug/l
Pyrene	nd	<10	ug/l
Benzidine**	nd	<10	ug/l
Butylbenzylphthalate	nd	<10	ug/l
3,3'-Dichlorobenzidine	nd	<10	ug/l
Benzo(a)anthracene	nd	<10	ug/l
Chrysene	nd	<10	ug/l
bis(2-Ethylhexyl)phthalate	nd	<10	ug/l
Di-n-octylphthalate	nd	<10	ug/l
Benzo(b)fluoranthene	nd	<10	ug/l
Benzo(k)fluoranthene	nd	<10	ug/l
Benzo(a)pyrene	nd	<10	ug/l
Indeno(1,2,3-cd)pyrene	nd	<10	ug/l
Dibenz(a,h)anthracene	nd	<10	ug/l
Benzo(g,h,i)perylene	nd	<10	ug/l

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SAMPLE ID Well ST-6S

FRACTION 05A

Date & Time Collected 07/12/91

VOLATILE ORGANIC ANALYSIS

COMPOUNDS	CONC.	DETECTION LIMIT	UNITS
Chloromethane	nd	△△0	ug/l
Vinyl Chloride	nd	△△0	ug/l
Bromomethane	nd	△△0	ug/l
Chloroethane	nd	△△0	ug/l
Trichlorofluoromethane**	nd	△△0	ug/l
Acrolein **	nd	△△0	ug/l
1,1-Dichloroethene	nd	△△0	ug/l
Acetone*	210	△△0	ug/l
Carbon Disulfide*	nd	△△0	ug/l
Methylene Chloride	23 B	△△0	ug/l
trans-1,2-Dichloroethene	nd	△△0	ug/l
Acrylonitrile **	nd	△△0	ug/l
1,1-Dichloroethane	nd	△△0	ug/l
Vinyl Acetate*	nd	△△0	ug/l
2-Butanone (MEK)*	nd	△△0	ug/l
cis-1,2-Dichloroethene	nd	△△0	ug/l
Chloroform	nd	△△0	ug/l
1,1,1-Trichloroethane	nd	△△0	ug/l
Carbon Tetrachloride	nd	△△0	ug/l
Benzene	nd	△△0	ug/l
1,2-Dichloroethane	nd	△△0	ug/l
Trichloroethene	nd	△△0	ug/l
1,2-Dichloropropane	nd	△△0	ug/l
Bromodichloromethane	nd	△△0	ug/l
4-Methyl-2-Pentanone (MIBK)*	nd	△△0	ug/l
cis-1,3-Dichloropropene	nd	△△0	ug/l
Toluene	nd	△△0	ug/l
trans-1,3-Dichloropropene	nd	△△0	ug/l
1,1,2-Trichloroethane	nd	△△0	ug/l
2-Hexanone (MEK)*	nd	△△0	ug/l
Tetrachloroethene	nd	△△0	ug/l
Dibromochloromethane	nd	△△0	ug/l
Chlorobenzene	nd	△△0	ug/l
Ethylbenzene	3 J	△△0	ug/l
1,1,1,2-Tetrachloroethane**	nd	△△0	ug/l
Total Xylenes*	13 J	△△0	ug/l
Styrene*	nd	△△0	ug/l
Bromoform	nd	△△0	ug/l
1,1,2,2-Tetrachloroethane	nd	△△0	ug/l
1,3-Dichlorobenzene**	nd	△△0	ug/l
1,4-Dichlorobenzene**	nd	△△0	ug/l
1,2-Dichlorobenzene**	nd	△△0	ug/l

nd = compound not detected
B = compound present in method blank
J = compound present below detection limit

* = non-TTO compound
** = non-IEPA target compound



Hydrology Division
2204 Griffith Drive
Champaign, Illinois 61820-7
Telephone (217) 333-
Telefax (217) 333-

November 27, 1991

Mr. John McDonnell, P.E.
Waste Management of Illinois, Inc.
P.O. Box 1309
Calumet City, Illinois 60409

Dear Mr. McDonnell:

I am sending you the results of our inorganic analyses from the July 12, 1991, sampling of ground water from the four shallow wells (ST-1S, ST-2S, ST-3S, and ST-4S) at the Interlake site. Please note that a fifth analysis, identified as ST-6S, is actually a field duplicate of ST-1S.

These inorganic analyses correspond to the organic analysis results we mailed to you in September, 1991. Sorry for the delay.

Should you have any questions or wish to discuss the attached information, please call.

Sincerely,

Stuart J. Cravens
Associate Hydrologist
Office of Ground-Water
Quality and Contamination
Phone: (217) 333-7951

SJC/psh

Enclosures



A Division of the

Illinois Department of Energy and Natural Resources

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SAMPLE	Sb mg/L	Se ^{exempt} mg/L .05	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L
ST-1S	<0.15	<0.11	2.26	<0.06	0.880	0.003
ST-2S	<0.15	<0.11	6.50	<0.06	0.577	<0.002
ST-3S	<0.15	<0.11	6.65	<0.06	0.270	0.223
ST-4S	<0.15	<0.11	10.74	<0.06	0.841	0.005
BLANK	<0.15	<0.11	<0.019	<0.06	<0.001	<0.002
ST-1S	<0.15	<0.11	2.29	<0.06	0.872	0.003
EST MDL	<0.15	<0.11	<0.019	<0.06	<0.001	<0.002

SAMPLE	Tl mg/L	V mg/L	Zn ^{exempt} mg/L 10	NH4 mg/L	F A mg/L	Cl ^{exempt} 200 mg/L
ST-1S	<0.24	<0.011	<0.003	33	4.6	7.3
ST-2S	<0.24	<0.011	0.003	40	0.5	83.3
ST-3S	<0.24	0.098	0.022	100	1.9	729
ST-4S	<0.24	<0.011	<0.003	50	1.5	251.0
BLANK	<0.24	<0.011	<0.003	<1	<0.1	<0.3
ST-1S	<0.24	<0.011	<0.003	33	4.5	7.6
EST MDL	<0.24	<0.011	<0.003	<0.02	<0.1	<0.3

SAMPLE	NO3 mg/L	o-PO4 mg/L	SO4 ^{exempt} A ⁰⁰ mg/L	Alk mg/L	TDS ^{exempt} 180 1200 in lab	pH ^{exempt} 6.5-9.0
ST-1S	<0.1	*	14.9	1122	1090	12.3
ST-2S	1.3	*	456	227	954	7.4
ST-3S	0.5	*	46.7	588	1945	9.6
ST-4S	0.2	*	3.5	1924	2229	7.7
BLANK	<0.1	*	<0.9	2	2	5.6
ST-1S	<0.1	*	13.6	1127	1099	12.3
EST MDL	<0.1	<0.1	<0.9	<2	<2	6.0

APPENDIX B

SURFACE WATER SAMPLING ANALYTICAL RESULTS

1.5c nitrogen 15-20

7 What is ammonia nitrogen concentration?

Based on Appat D for indigenous wildlife

Appendix Table 1. Big Marsh Water Sampling Results 1990-1991 (continued)
(Values are mg/l)

SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-1	SW-2	SW-2	SW-2
7/90	8/90	10/90	12/90	3/91	4/91	5/91	7/90	8/90	10/91	
Element										
Acetone ✓	.010	BDL	BDL	BDL	BDL	.007	BDL	BDL	BDL	.018
0.1 Ammonia (Unionized) ✓	.095	.307 ¹	.053 ¹	.197 ¹	.449 ¹	.233 ¹	.317	.125	.423	.046
10 Arsenic ✓	BDL	BDL	.003	BDL	BDL	BDL	BDL	BDL	BDL	.003
5.0 Barium ✓	.098	.087	.120	.100	.100	.130	.110	.086	.110	.090
Benzene ✓	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Beryllium ✓	BDL	BDL	BDL	BDL	BDL	BDL	BDL	-	-	BDL
1.0 Boron ✓	1.400 ¹	1.200 ¹	1.300 ¹	.780	.870	1.000	.940	1.400 ¹	1.300 ¹	1.200 ¹
15 Cadmium ✓	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1 Chromium (Total) ✓	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
3 Chromium (VI) ✓	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1.0 Copper ✓	BDL	BDL	BDL	BDL	BDL	.010	BDL	BDL	BDL	BDL
0.05 Cyanide ✓	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
76.0 Dissolved Oxygen ✓	-	-	-	-	5.100 ¹	5.200 ¹	13.500	-	-	-
Hardness ✓	-	-	-	-	369.000	408.000	358.000	-	-	-
0.5 Iron (Dissolved) ✓	BDL	.250	BDL	.040	BDL	.055	BDL	.051	BDL	.044
2.0 Iron (Total) ✓	1.600	1.200	1.200	1.700	.860	-	1.300	1.500	1.500	1.700
1.0 Lead ✓	BDL	.020	.019	.014	.005	1.300 ¹	.008	BDL	.015	.024
1.0 Manganese ✓	.240	.180	.190	.130	.150	.170	.160	.220	.190	.250
.0005 Mercury ✓	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Oil & Grease ✓	BDL	16.000	BDL	BDL	BDL	BDL	BDL	29.000	BDL	BDL
Temp (C) ✓	18.100	24.500	12.500	2.000	6.200	12.500	21.700	16.700	24.500	11.100
Titanium ✓	.010	.016	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium ✓	BDL	BDL	BDL	BDL	BDL	BDL	BDL	.010	BDL	BDL
1.0 Zinc ✓	.020	.030	.016	.020	.015	BDL	.063	.024	.018	.020
6.9 pH ✓	8.510	8.580	8.160	8.290	8.340	8.140	8.790	8.550	8.920	8.370

1500

500

Value exceeds IEPA General Use Water Quality Standards, Title 35; Subtitle C Section 302

BDL Value falls below detection limit.

SILVER 500.1

Selenium 1.0

15 Chloride 500

DO 3.9

Appendix Table 1. Big Marsh Surface Water Sampling Results 1990-1991 (continued)
(Values are mg/l)

Element	SW-2 3/91	SW-2 4/91	SW-2 5/91	SW-3 ¹ 7/90	SW-3 8/90	SW-3 10/90	SW-3 12/90	SW-3 3/91	SW-3 4/91	SW-3 5/91
Acetone	.018	.015	BDL	BDL	BDL	BDL	BDL	BDL	.015	BDL
.04 Ammonia (Unionized)	.497 ¹	.670 ¹	.231	.003	.006	.018	.025	.017	.037	.029
.17 Arsenic	BDL	BDL	.002	BDL	BDL	BDL	BDL	BDL	BDL	BDL
5.0 Barium	.086	.120	.097	BDL	BDL	BDL	.058	.057	.064	.054
Benzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Beryllium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1.0 Boron	.780	1.000	.930	.450	.420	.420	.380	.370	.390	.350
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium (Total)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
.016 Chromium (VI)	BDL	BDL	BDL	BDL	.039 ¹	BDL	BDL	BDL	BDL	BDL
Copper	BDL	.005	BDL	BDL	BDL	BDL	BDL	BDL	.007	BDL
.005 Cyanide	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
76.0 Dissolved Oxygen	-	5.800 ¹	-	-	-	-	-	8.500	4.400 ¹	10.000
Hardness	357.000	423.000	362.000	-	-	-	-	365.000	400.000	357.000
1.0 Iron (Dissolved)	.043	.038	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Iron (Total)	1.300	-	.770	.170	.140	.340	.490	.250	-	.110
.10 Lead	.006	.006	.010	BDL	.003	.008	.004	BDL	.004	BDL
1.0 Manganese	.140	.160	.140	.460	.140	.120	.025	.076	.085	.032
.05 Mercury	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Oil & Grease	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Temp (C)	7.800	13.600	15.600	19.900	22.900	14.300	3.600	5.400	12.300	17.100
Titanium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1.0 Zinc	.010	BDL	BDL	BDL	BDL	.018	BDL	BDL	BDL	BDL
pH	8.440	8.540	8.440	7.180	7.610	8.030	8.410	8.260	8.240	8.080

¹ Value exceeds IEPA General Use Water Quality Standards, Title 35: Subtitle C Section 302
BDL Value falls below detection limit.

Appendix Table 1: Big Marsh Surface Water Sampling Results 1990-1991 (continued)
(Values are mg/l)

Element	SW-0 7/90	SW-4 8/90	SW-4 10/90	SW-5 7/90	SW-6 7/90	SW-6 8/90	SW-6 10/90	SW-6 12/90	SW-6 3/91
Acetone	.018	.017	.031	BDL	BDL	BDL	.036	BDL	.016
.64 Ammonia (Unionized)	4.609 ¹	3.623 ¹	7.478 ¹	1.599 ¹	.002	.011	.036	.006	.046 ¹
.19 Arsenic	BDL	BDL	.002	BDL	BDL	BDL	BDL	BDL	BDL
.50 Barium	.150	.120	.150	.110	BDL	.051	BDL	BDL	BDL
Benzene	.002	.002	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Beryllium	.002	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1.0 Boron	2.700 ¹	2.000 ¹	3.600 ¹	2.300 ¹	.350	.340	.350	.230	.220
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium (Total)	.035	.023	.070	BDL	BDL	BDL	BDL	BDL	BDL
.011 Chromium (VI)	BDL	BDL	BDL	BDL	BDL	.710 ¹	BDL	BDL	BDL
Copper	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
.005 Cyanide	.016 ¹	.021 ¹	.034 ¹	BDL	BDL	.028 ¹	.017 ¹	BDL	BDL
>6.0 Dissolved Oxygen	-	-	-	-	-	-	-	-	8.700
Hardness	-	-	-	-	-	-	-	-	455.000
1.6 Iron (Dissolved)	1.100 ¹	.740	.930	.600	BDL	BDL	BDL	BDL	BDL
Iron (Total)	1.500	1.200	1.100	1.100	.280	.530	.920	1.200	.400
.10 Lead	BDL	.013	.029	BDL	BDL	.004	.009	.009	.006
1.0 Manganese	.290	.310	.054	.230	.021	.110	.087	.046	.064
.005 Mercury	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Oil & Grease	BDL	BDL	6.000	BDL	BDL	BDL	BDL	BDL	BDL
Temp (C)	17.700	21.700	12.900	22.300	17.200	24.800	10.000	2.100	6.400
Titanium	.028	.033	.084	.024	BDL	BDL	BDL	.027	BDL
Vanadium	.017	.012	.027	.013	BDL	BDL	BDL	BDL	BDL
1.6 Zinc	.020	.020	.030	.059	.018	BDL	.025	.046	.022
pH	8.100	8.130	8.380	7.970	7.220	7.620	8.010	7.910	8.250

¹ Value exceeds IEPA General Use Water Quality Standards, Title 35: Subtitle C Section 302.
BDL Value falls below detection limit.

Appendix Table 1: Big Marsh Surface Water Sampling Results 1990-1991 (continued)
(Values are mg/l)

Element	SW-6 4/91	SW-6 5/91	SW-7 8/90	SW-7 10/90	SW-8 8/90	SW-8 10/90	SW-8 12/90	SW-8 3/91	SW-8 4/91	SW-8 5/91
Acetone	.008	BDL	.029	BDL	.033	.025	BDL	.073	.023	BDL
Ammonia (Unionized)	.017	.058	.008	.006	.879	.400 ¹	2.027 ¹	2.562 ¹	1.044 ¹	.942
Arsenic	BDL	BDL	BDL	BDL	BDL	.004	BDL	BDL	BDL	.003
Barium	BDL	BDL	.071	.054	BDL	.059	BDL	BDL	BDL	BDL
Benzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Beryllium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Boron	.310	.300	.440	.370	.660	.710	.540	.290	.460	.470
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium (Total)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium (VI)	BDL	BDL	BDL	BDL	BDL	.038 ¹	BDL	BDL	BDL	BDL
Copper	.010	BDL	BDL	BDL	BDL	BDL	BDL	BDL	.007	BDL
Cyanide	BDL	BDL	BDL	.023	BDL	BDL	BDL	BDL	BDL	BDL
Dissolved Oxygen	3.600 ¹	13.100	-	-	-	-	-	7.800	4.100 ¹	10.300
Hardness	538.000	422.000	-	-	-	-	-	151.000	159.000	150.000
Iron (Dissolved)	.100	BDL	BDL	.044	BDL	BDL	.030	BDL	.064	BDL
Iron (Total)	-	.890	1.800	.980	.720	1.000	.630	.380	-	.430
Lead	.009	.006	.002	.021	.018	.033	.012	.009	.010	.020
Manganese	.110	.051	.370	.240	.095	.160	.053	.025	.052	.054
Mercury	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Oil & Grease	BDL	BDL	BDL	BDL	38.000	BDL	BDL	BDL	BDL	BDL
Temp (C)	8.600	22.700	25.000	11.700	21.600	11.000	1.800	5.900	9.100	19.800
Titanium	.027	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Zinc	.024	BDL	BDL	.011	BDL	.015	.015	BDL	BDL	BDL
pH	8.170	8.410	7.370	7.570	10.040 ¹	9.160 ¹	9.890 ¹	11.680 ¹	10.010 ¹	10.160 ¹

¹ Value exceeds IEPA General Use Water Quality Standards, Title 35: Subtitle C Section 302
BDL Value falls below detection limit.

Appendix Table 1: Big Marsh Surface Water Sampling Results 1990-1991 (continued)
(Values are mg/l)

Element	SW-9 8/90	SW-9 10/90	SW-9 12/90	SW-9 3/91	SW-9 4/91	SW-9 5/91	SW-10 8/90	SW-10 10/90	SW-10 12/90	SW-10 3/91
Acetone	BDL	.027	BDL	.022	.011	BDL	BDL	BDL	.047	.019
.04 Ammonia (Unionized)	.424	.167 ¹	.240 ¹	.943 ¹	.680 ²	.322	.129	.055	.090 ¹	.397 ¹
.19 Arsenic	BDL	BDL	BDL	BDL	BDL	BDL	BDL	.004	BDL	BDL
5.0 Barium	.085	.110	.093	.073	.099	.087	.120	.110	.100	.096
Benzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Beryllium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1.0 Boron	1.100 ¹	1.200 ¹	.810	.980	1.000	.960	1.200 ¹	1.300 ¹	.830	.760
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium (Total)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
.016 Chromium (VI)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Copper	BDL	BDL	BDL	BDL	.010	BDL	BDL	BDL	BDL	BDL
.05 Cyanide	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
7.0 Dissolved Oxygen	-	-	-	8.300	4.200 ¹	14.300	-	-	-	-
Hardness	-	-	-	382.000	381.000	340.000	-	-	-	351.000
1.0 Iron (Dissolved)	BDL	BDL	.035	.071	BDL	BDL	.053	.055	BDL	.055
Iron (Total)	1.500	1.500	1.600	.850	-	.720	BDL	BDL	BDL	1.500
.10 Lead	.018	.024	.016	.008	.010	.012	.069	.042	.017	.006
1.6 Manganese	.140	.180	.120	.110	.120	.120	.200	.280	.160	.140
.005 Mercury	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Oil & Grease	BDL	BDL	BDL	BDL	BDL	9.000	50.000	BDL	BDL	BDL
Temp (C)	25.000	10.800	2.400	6.300	10.700	22.700	24.200	11.700	1.300	5.600
Titanium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Vanadium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1.0 Zinc	BDL	.024	.034	.018	BDL	BDL	.021	.044	.020	.013
pH	9.170 ¹	8.690	8.420	8.810	8.650	8.810	8.370	8.350	8.120	8.360

¹ Value exceeds IEPA General Use Water Quality Standards, Title 35: Subtitle C Section 302

Appendix Table 1. Big Marsh Surface Water Sampling Results 1990-1991 (continued)
(Values are mg/l)

Element	SW-10 4/91	SW-10 5/91	SW-11 12/90	SW-11 3/91	SW-11 4/91	SW-11 5/91	SW-12 12/90	SW-12 3/91	SW-12 4/91	SW-12 5/91
Acetone	.007	BDL	.010	.018	.010	BDL	BDL	.021	.009	BDL
.04 Ammonia (Unionized)	.338	.250	.242 ¹	.406 ¹	.144	2.870 ¹	.164 ¹	.173 ¹	.140 ¹	.333 ¹
.19 Arsenic	BDL	BDL	BDL	BDL	BDL	.005	.002	BDL	BDL	BDL
5.0 Barium	.140	.110	.093	.092	.060	.120	.140	.078	.100	.092
Benzene	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Beryllium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1.0 Boron	1.000	.930	1.100 ¹	1.000	.740	1.500 ¹	.850	.740	.980	.960
Cadmium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Chromium (Total)	BDL	BDL	.022	BDL	.002	BDL	BDL	BDL	BDL	BDL
.01 Chromium (VI)	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Copper	.007	BDL	.024	BDL	.020	.021	BDL	BDL	.007	BDL
.005 Cyanide	BDL	BDL	.013 ¹	BDL	.023 ¹	.022 ¹	3.000 ¹	.051 ¹	.033 ¹	.100 ¹
76.0 Dissolved Oxygen	5.000 ¹	14.200	-	3.500 ¹	4.000 ¹	5.200 ¹	-	7.600	3.100 ¹	8.800
Hardness	417.000	352.000	-	438.000	354.000	418.000	-	391.000	428.000	370.000
1.0 Iron (Dissolved)	.040	BDL	.320	.340	.400	.690	.069	.130	.180	BDL
Iron (Total)	-	1.100	1.000	BDL	-	BDL	BDL	BDL	-	7.700 ¹
.10 Lead	.008	.009	.009	.017	.010	.031	.028	.009	.007	.014
1.0 Manganese	.170	.160	.180	.210	.220	.220	.270	.230	.210	.190
.0005 Mercury	BDL	BDL	BDL	BDL	BDL	BDL	0.00058 ¹	BDL	BDL	BDL
Oil & Grease	BDL	BDL	60.000	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Temp (C)	13.200	21.400	2.800	5.600	12.900	24.200	2.700	6.300	8.900	21.300
Titanium	BDL	BDL	BDL	.020	BDL	.033	.140	.018	BDL	BDL
Vanadium	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
1.0 Zinc	BDL	BDL	.034	.059	.024	.049	.047	.021	BDL	BDL
pH	8.260	8.670	8.030	8.000	7.900	8.120	8.240	8.070	8.000	8.180

¹ Value exceeds IEPA General Use Water Quality Standards, Title 35; Subtitle C Section 302
BDL Value falls below detection limit.



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Project #: 931319
C.O.C. #: 14501
Date : 08/18/93

Rust Environment & Infrastructure, Inc.
1240 E. Diehl Road
Naperville, IL 60563

ATTN: Bud Schultz

Sampling Date: 08/04/93
Analyses Date: 08/05-18/93

Identification: Twelve samples taken by Bud Schultz identified
as:
INTERLAKE

Results follow:

**TOTAL Cyanide and
REACTIVE Cyanide Analyses**
Method: SW846 9010 & 7.3.3.2

<u>Sample ID: 931319-01-10</u>			<u>PQL (mg/L)</u>	<u>Total Cyd. Analysis</u>	<u>Reactive Cyd. Analysis</u>
No.01	SW-4-L	0.02	ND	ND	
No.02	SW-4-I	0.02	ND	ND	
No.03	SW-4-R	0.02	ND	ND	
No.04	SW-4-S	0.02	ND	ND	
No.05	SW-12-S	0.02	0.2	*	
No.06	SW-12-R	0.02	0.2	ND	
No.07	SW-12-L	0.02	0.3	ND	
No.08	SW-12-1	0.02	0.05	ND	
No.09	SW-4-Soil	0.02 mg/Kg	6.1	ND	
No.10	SW-18-Soil	0.02 mg/Kg	1.8	ND	
No.11	Trip Blank (H ₂ O)	0.02 mg/L	ND	ND	
No.12	Trip Blank(Soil)	0.02 mg/Kg	ND	ND	

*Note: Non-Conformance Report (NCR) - Insufficient sample to complete test.

ND = Not Detected at or above the PQL
PQL = Practical Quantitation Limit

Respectfully submitted,

Paulius T. Alekna
Paulius (Paul) T. Alekna
Lab Director
Quality Analytical Labs, Inc.

sy:RU931319

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NON-CONFORMANCE REPORT

Non-Conformance Report ID : NCR -

Date : 8/18

Section 1 - Project Information

Client Identification : RUST

QAL Identification : ~~RUST~~ 931319

CDC Identification :

Analytical Parameter : CN

Method : SW-846 7.3.3.2

Sample(s) Affected : 05

Section 2 - Description of Non-ConformanceOccurance First ☐ Second ☐ Third ☐

Surrogate Identification(s) :

☐ Surrogate recovery outside QA/QC limits due to matrix effect☐ Surrogate recovery outside QA/QC limits. HIGH ☐ LOW ☐

Specify :

☐ Internal standard area counts outside of QA/QC limits due to matrix effect☐ Internal standard area counts outside of QA/QC limits

Specify :

☐ Other

Specify :

Section 3 - Non-Conformance Impact

05 - USED SAMPLE for MS + MSD in addition
to using as regular sample when running TOTAL CW
Therefore had no sample left for Rx

Section 4 - Additional Comments

Section 5 - Supervisor's Comments

Section 6 - Non-Conformance Report Closure

Analyst(s) : <u>VE</u>	Date : <u>8/17</u>
Reviewed : <u>LAK</u>	Date : <u>8/18</u>



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Root E & P
Company Name
1240 E Diehl Rd
Address

9/17/9
N° 14501

CHAIN OF CUSTODY RECORD

PROJECT NUMBER		PROJECT NAME					NO OF CON- TAINERS	REMARKS					
SAMPLERS (Signature)		Interlake						Total Cyanide Reactive Cyanide					
ITEM NO	STA NO	DATE	TIME	COMP.	GRAB	STATION LOCATION							
01	SW-4	8/4/93	12:30		X	SW-4-L	1	X	X				
02						SW-4-L	2						
03						SW-4-L	1						
04						SW-4-S	1						
05	SW-12		1400			SW-12-S	1						
06						SW-12-R	1						
07						SW-12-L	1						
08						SW-12-L	1						
09	SW-4		12:30			SW-4-Soil	2						
10	SW-12		1400			SW-12-Soil	1						
11						TRIP BLANK (HILL)	1						
12						TRIP BLANK (SILT)	1						
13													
14													
15													

Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
Relinquished by (Signature)	Date/Time	Received for Laboratory by (Signature)	Date/Time	Remarks	
BQ Subo	8/4/93 6:55	Mud	8/4/93 6:55		



QUALITY
ANALYTICAL
LABS, INC.

December 27, 1993

Mr. B. Schultz
Rust Inc.
1240 E. Diehl Rd. Suite 500
Naperville, IL 60563

Dear Mr. Schultz,

This letter is in response to your request that we explain in a bit more detail the detection limits we use generally and how they relate to those you require for your periodic testing.

We have recently recalibrated our cyanide test methods. This involves running several water samples with known low level cyanide concentrations through the test. We then use a statistical calculation on the results to derive the method detection limit. The result for waters in which 250mls of sample is used was 0.034 mg/L which mathematically could be rounded down to 0.3 but we rounded up to 0.04 mg/L for our water detection limit. This rounding up process is used to give us a bit of a "comfort zone" since real world samples are seldom as well behaved as the lab test samples used to determine detection limits as outlined by the EPA method.

Our soil detection limit is based on the fact that 20g of soil is used rather than 250mls (250g) for waters. Thus the detection limit for soils is:

$$0.034 \times 250/20 = 0.425 \text{ mg/kg}$$

Again this can be mathematically rounded down to 0.4 mg/kg but we normally round it up to 0.5 mg/kg to provide our "comfort zone" for real world samples.

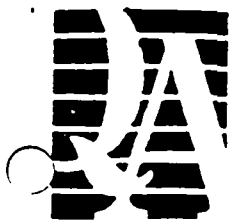
In the case of your soil samples submitted under QAL project # 932245 we were unaware that you were looking for the specific target detection limit of 0.4 mg/kg for soils so we proceeded to run and report the cyanide results in our normal fashion. Fortunately, our "comfort zone" does allow us to amend that report with detection limits of 0.4 mg/kg. This detection limit is correct and valid as defined by the method.

In the future, if you continue to require the target detection limit of 0.4 mg/kg on soils it would help us if you mark this on the incoming chain of custody and also inform your QAL sales representative. If it is marked, we will run 40g rather than 20g of your sample (including a matching 40g blank sample for comparison) and this will give you a detection limit of :

$$0.034 \times 250/40 = 0.2125 \text{ mg/kg}$$

We will round this up to a reported detection limit of 0.3 mg/kg, giving us our "comfort zone" while giving you

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a detection limit below your target requirements.

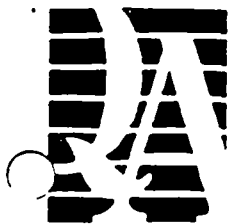
I hope this letter answers your concerns about our detection limits. Again I would like to emphasize that the detection values in our amended report are completely valid and defensible. If you have any further questions please feel free to contact me at any time.

Sincerely,

Douglas Weir, Ph.D.
QCO, Quality Analytical Labs

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Project #: 932245 Amended
C.O.C. #: 14494
Date: 12/28/93

Rust Environmental & Infrastructure
1240 E. Diehl Road
Naperville, IL 60563

Attn: Ralph Bonk

Sampling Date: 11/30/93
Analyses Date: 12/2-14/93

Identification: Thirteen samples taken by Bud. S. identified as:

INTERLAKE
PROJECT # 71136.100

Results follow:

Sample ID: SW-4-Shallow 932245-01

Parameter	PQL	Analysis	Method
			SW846
Reactive Cyanide	0.04 mg/L	U	7.3.3.2
Total Cyanide	0.04 mg/L	U	9010

Sample ID: SW-4-1 932245-02

Parameter	PQL	Analysis	Method
			SW846
Reactive Cyanide	0.04 mg/L	U	7.3.3.2
Total Cyanide	0.04 mg/L	U	9010

Sample ID: SW-4-1 Dup 932245-03

Parameter	PQL	Analysis	Method
			SW846
Reactive Cyanide	0.04 mg/L	U	7.3.3.2
Total Cyanide	0.04 mg/L	U	9010

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Sample ID: SW-4-Left 932245-04
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

Sample ID: SW-4-Right 932245-05
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

Sample ID: SW-4-Soil 932245-06
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.40 mg/Kg U 7.3.3.2
Total Cyanide 0.40 mg/Kg U 9010

Sample ID: SW-12-Shallow 932245-07
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

Sample ID: SW-12-1 932245-08
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

Sample ID: SW-12-Left 932245-09
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

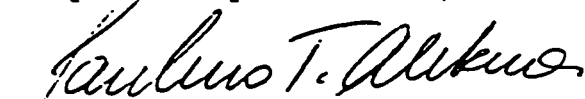
<u>Sample ID:</u> SW-12-Right 932245-10			
Parameter	PQL	Analysis	Method SW846
Reactive Cyanide	0.04 mg/L	U	7.3.3.2
Total Cyanide	0.04 mg/L	U	9010

<u>Sample ID:</u> SW-12-Soil 932245-11			
Parameter	PQL	Analysis	Method SW846
Reactive Cyanide	0.40 mg/Kg	U	7.3.3.2
Total Cyanide	0.40 mg/Kg	U	9010

<u>Sample ID:</u> Trip Blank H2O 932245-12			
Parameter	PQL	Analysis	Method SW846
Reactive Cyanide	0.04 mg/L	U	7.3.3.2
Total Cyanide	0.04 mg/L	U	9010

<u>Sample ID:</u> Trip Blank Soil 932245-13			
Parameter	PQL	Analysis	Method SW846
Reactive Cyanide	0.40 mg/Kg	U	7.3.3.2
Total Cyanide	0.40 mg/Kg	U	9010

Respectfully submitted,


Paulius (Paul) T. Alekna
Lab Director
Quality Analytical Labs, Inc.

ps:RU932245

EPA - Defined Data Qualifiers

- B** Compound detected in blank (Normalized concentration)
Used when blank value exceeds half of the CRDL (PQL).
- C** Pesticide result confirmed by GC/MSD
- D** Compound identified in analysis at a secondary dilution factor
Used when two or more dilutions of a sample are needed to acquire valid data.
- E** Compounds concentration exceeds calibration range
Used when upper level of calibration curve is exceeded by 10%. Analyses greater than 50% of upper calibration level are reanalyzed at a higher dilution.
- J** Estimated value. Compound detected below the CRDL (PQL):
- P** Pesticide or Aroclor analysis where results between analytical and confirmation columns is > 25%.
- U** Compound analyzed for but not detected at or above the CRDL (PQL).
- X** *NON-Specific flag - See definition at the end of the report*

Data Validation Qualifiers

- NJ** Presumptive evidence of presence of material at an estimated quantity.
Used when QA/QC failures are present AND data is true. Must be accompanied by NCR
- PND** Precision Not Determined
Used when non-approved methods are used to obtain data.
- R** Reported value is unusable due to gross QA/QC deficiencies.
- RND** Recovery Not Determined
Used when non-approved methods are used to obtain data.
- UJ** Compound analyzed for but not detected, reported detection limit estimated because QA/QC criteria were not met.

Detection Limit Definitions

- CRDL** Contract Required Detection Limits = Detection limits specified by client or agency
Based on wet weight analysis
- IDL** Instrument Detection Limit
Statistically derived detection limit from 7 + analyses of a low level standard near but above the estimated Method Detection Limit.
- MDL** Method Detection Limit
Instrument Detection Limit X End Volume (specified by the method) / Mass, Volume or Area of the Sample (specified by the method) (Based on wet weight analysis)
- PQL** Practical Quantitation Limit
Method Detection Limit X End Volume (analytical) / Mass, Volume or Area of the Sample (analytical) (Based on wet weight analysis)



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RUST E & I

Company Name

1240 E. Dick Rd, Naperville, IL 60563

Address

932245

N° 14494

CHAIN OF CUSTODY RECORD

PROJECT NUMBER		PROJECT NAME					NO. OF CON- TAINERS	Total Cyanide Reactive Cyanide				REMARKS	
7136.100		Interlake											
SAMPLERS: (Signature) BOS													
ITEM NO	STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION							
1	SW-4	11/30/93	14:40		X	SW-4 - Shallow	1	X	X				<p>(H₂O)</p> <p>↓</p> <p>(SOIL)</p> <p>(H₂O)</p> <p>↓</p> <p>(SOIL)</p> <p>(H₂O)</p> <p>(SOIL)</p>
2						SW-4 - 1	1	X	X				
3						SW-4 - 1 Dup	1	X	X				
4						SW-4 - Left	1	X	X				
5						SW-4 - Right	1	X	X				
6	↓		↓			SW-4 - Soil	1	X	X				
7	SW-12		13:50			SW-12 - Shallow	1	X	X				
8						SW-12 - 1	1	X	X				
9						SW-12 - Left	1	X	X				
10						SW-12 - Right	1	X	X				
11	↓	↓	↓			SW-12 - Soil	1	X	X				
12	Trip					Trip BLANK (H ₂ O)	1	X	X				
13	Trip					Trip BLANK (Soil)	1	X	X				
14													
15													

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	12/2/93 5:45	Di On			
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	
BOS	12/13/93 4:45	Frank Wagg			



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

92201

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Report Date: 3/14/94
Sample Received: 3/4/94

Project Name: Interlake
Sample Description: Water

Sample No.:	Location	Reactive Cyanide	Total Cyanide
75020	SW-4-1	<0.02	<0.02
75021	SW-4-Dup	<0.02	<0.02
75022	SW-4-Shallow	<0.02	<0.02
75023	SW-4-L	<0.02	<0.02
75024	SW-4-R	<0.02	<0.02
75026	SW-12-1	<0.02	<0.02
75027	SW-12-Shallow	<0.02	<0.02
75028	SW-12-L	<0.02	<0.02
75029	SW-12-R	<0.02	0.030

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

LABORATORY DIRECTOR



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FAX: 708/967-6735

LABORATORY REPORT

92203

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Report Date: 3/14/94
Sample Received: 3/7/94

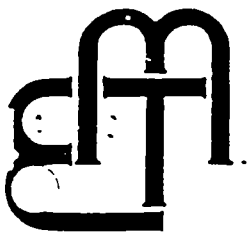
Project Name: Interlake
Sample Description: Water Blank
Sample No.: 75102

Reactive Cyanide	<0.02
Total Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Methods performed according to SW-846, "Test Methods for Evaluating Solid Waste".

LABORATORY DIRECTOR



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LABORATORY REPORT

92202

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Report Date: 3/14/94
Sample Received: 3/4/94-

Project Name: Interlake
Sample Description: Soil

Sample No.:	Location	Reactive Cyanide	Total Cyanide
75025	SW-4-Soil	<0.2	1.91
75030	SW-12-Soil	0.29	1.94
75031	Blank-Soil	<0.11	0.101

All results expressed as ppm unless otherwise indicated.

Methods performed according to SW-846, "Test Methods for Evaluating Solid Waste".

LABORATORY DIRECTOR



MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203

708-967-6666
FAX: 708/967-6735

Due Date: _____ COC #: 3448

Company: Rust
Address: 1240 E Diehl Rd
Naperville, IL 60563
Phone #: 708-955-6795 Fax #: ()
P.O. #: _____ Proj. #: _____
Client Contact: Bud Schultz
Project ID / Location: Interlake

Sample Type: Container Type:

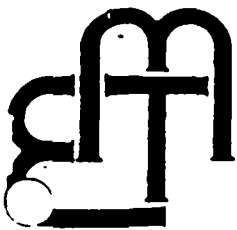
- | | |
|-----------------------------------|---------------------|
| 1. Water | P - Plastic |
| 2. Soil | G - Glass |
| 3. Sludge | V - VOC |
| 4. Oil | |
| 5. Waste | |
| Other: _____ | |
| Preservative: | |
| 1. None | 3. HNO ₃ |
| 2. H ₂ SO ₄ | 4. NaOH |

Analyses

Sample I.D. (10 Characters ONLY)	Sample Type	Container			Sampling		Preservative	Lab I.D.	Total CN Reactive CN										Comments
		Size	Type	No.	Date	Time													
Sw-4-1	1	12	G	1	3/4/94	10:30	1	75020	X	X									
Sw-4-Dup	1							75021											
Sw-4-Shallow	1							75022											
Sw-4-L	1							75023											
Sw-4-R	1							75024											
Sw-4-Soil	2							75025											
Sw-12-1	1					10:45		75026											
Sw-12-Shallow	1							75027											
Sw-12-L	1							75028											
Sw-12-R	1							75029											
Sw-12-Soil	2	✓	✓	✓	✓	✓	✓	75030	✓	✓									
								75031											

EMI does not accept samples that contain high levels of Cyanide. ~~174~~

Relinquished By:	Date: -- -- Time: :	Received By:	Date: -- -- Time: :	Witness:	TURNAROUND TIME: <input type="checkbox"/> RUSH ____ day turnaround <input checked="" type="checkbox"/> ROUTINE
Relinquished By: <u>B. Schultz</u>	Date: <u>3-4-94</u> Time: :	Received For Lab By: <u>Anthony Hunter</u>	Date: <u>3-4-94</u> Time: <u>21:00</u>		



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

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Morton Grove, Illinois 60053-3203
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LABORATORY REPORT

101784

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-4-1
Sample No.: 37154

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.011
Reactive Cyanide	<0.02

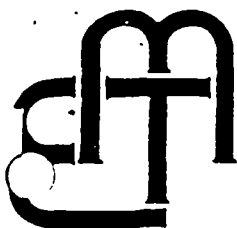
4

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101785

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-4-Shallow
Sample No.: 87155

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.010
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

Gary W. Wiegman



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
708/967-6556
FAX: 708/967-6735

LABORATORY REPORT

101786

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-4-L
Sample No.: 37156

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.008
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

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Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101787

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-4-R
Sample No.: 87157

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide 0.008

Reactive Cyanide <0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101793

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Soil - SW-4-Soil
Sample No.: 87158

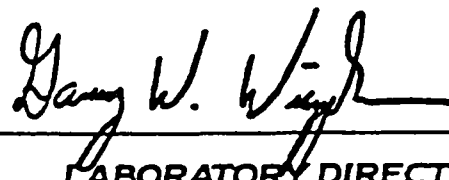
Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	3.37
Reactive Cyanide	0.03

All results expressed as ppm unless otherwise indicated.

Methods performed according to SW-846, "Test Methods for Evaluating Solid Waste".

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.


LABORATORY DIRECTOR



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101788

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-12-1
Sample No.: 87159

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.012
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR



**ENVIRONMENTAL
MONITORING AND
TECHNOLOGIES, INC.**

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101789

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-12-Shallow
Sample No.: 87160

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.011
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

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LABORATORY REPORT

101790

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-12-L
Sample No.: 87161

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.009
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

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LABORATORY REPORT

101791

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-12-R
Sample No.: S7162

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide . 0.011

Reactive Cyanide <0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

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Morton Grove, Illinois 60053-3203
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LABORATORY REPORT

101794

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Soil - SW-12-Soil
Sample No.: S7163

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	2.81
Reactive Cyanide	0.23

All results expressed as ppm unless otherwise indicated.

Methods performed according to SW-846, "Test Methods for Evaluating Solid Waste".

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

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Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101792

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-12-1 Dup
Sample No.: 37164

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide 0.008

Reactive Cyanide <0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR

APPENDIX C

SOIL AND SEDIMENT SAMPLING ANALYTICAL RESULTS

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX C
INTERLAKE SITE
CHICAGO, ILLINOIS

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Chloromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromomethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Chloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Methylene Chloride	3 0 J	--	--	0 9 J	4 0 J	--	2 0 J	4 0 J	2 0 J	2 0 J	3 0 J	3 0 J	36 0	3 0 J
Acetone	76 0 DJ	3200 0 D	300 0 D	99 0	880 0 DJ	11000 0 D	--	130 0 J	80 0 J	110 0 J	49 0 J	62 0 J	5000 0	--
Carbon Disulfide	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1-Dichloroethene (total)	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone	R	R	R	R	R	R	--	9 0 J	--	R	R	2 0 J	310 0 J	R
1,1,1-Trichloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Carbon Tetrachloride	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl Acetate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX C
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Dibromochloromethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-pentanone	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Hexanone	--	--	--	--	--	--	--	48.0	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	--	--	--	--	--	--	--	--	--	--	--	10.1	--	--
Chlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Styrene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Xylene (total)	--	--	--	--	--	--	--	0.5 J	--	--	--	--	--	--
Fluorene	--	--	--	--	--	--	--	--	360.0 J	--	130.0 J	25.0 J	93.0 J	--
4-Nitroaniline	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4,6-Dinitro-2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Bromophenyl Phenylether	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX C
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Pentachlorophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	--	0.4 J	--	--	--	0.5 J	6100 J	--	52000	2400 J	16000	5400 J	6900 J	2600 J
Anthracene	--	--	--	--	--	--	480 J	--	8100 J	--	2500 J	900 J	510 J	--
Dibutylphthalate	--	0.2 J	--	--	--	--	--	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	--	--	9700 J	--	51000	3700 J	28000	9900	--	5900 J
Pyrene	--	--	--	--	--	--	8800 J	--	46000	3300 J	27000	9400	--	6700 J
Butylbenzylphthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3'-Dichlorobenzidine	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	6400 J	--	45000	--	28000	4600 J	--	400 J
Chrysene	--	--	--	--	--	--	4200 J	--	45000	--	23000	4100 J	--	2900 J
Bis(2-ethylhexyl)phthalate	--	0.2 J	1.0 J	--	9.0 J	--	--	--	--	--	--	--	--	--
Di-n-octyl phthalate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	--	--	--	--	--	--	5100 J	--	74000	--	50000	4300 J	--	--
Benzo(k)fluoranthene	--	--	--	--	--	--	--	--	37000	--	34000	--	--	--
Benzo(a)pyrene	--	--	--	--	--	--	--	--	41000	--	46000	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--	--	--	--	--	48000	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Alpha-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Beta-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX C
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Delta-BHC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Gamma-BHC (Lindane)	--	--	--	--	--	--	--	69 8 J	--	--	--	--	--	--
Heptachlor	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endrin	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan I	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Dieldrin	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan II	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan sulfate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Phenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethyl)ether	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorophenol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	--	--	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	--	--	--	--	--	--	--	--	--	--	--	--	--	--
2-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	120 0 J	--
Bis(2-chloroisopropyl)ether	--	--	--	--	--	--	--	--	--	--	--	--	--	--
4-Methylphenol	--	--	--	--	--	--	--	--	--	--	--	--	5000 0	--
N-Nitrosodi-n-propylamine	--	--	--	--	--	--	--	--	--	--	--	--	--	--

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX C
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Aroclor 1242	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1248	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1254	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor 1260	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aluminum	110 0 B	210 0	260 0	149 0	140 0 B	720 0	51000 0	5600 0	6400 0	6500 0	8800 0	4900 0	770 0	5900 0
Antimony	--	--	--	--	--	--	--	--	0 7 B	--	--	--	--	1 4 B
Arsenic	--	--	--	--	--	3 0 B	4 8	7 6 B	5 1	4 6	3 6	2 7	2 9 B	4 9
Barium	21 0 B	79 0 B	14 0 B	23 0 B	21 0 B	28 0 B	520 0	144 0	83 0	75 0	220 0	75 0	450 0	122 0
Beryllium	--	--	--	--	--	--	7 3	0 4	0 9 B	0 5 B	1 6	0 4 B	--	0 5 B
Cadmium	--	--	--	--	--	--	0 7 B	0 7	1 3	1 0 B	18 0	0 7 B	--	1 1
Calcium	8900 0	87000 0	13500 0	20000 0	19000 0	11000 0	236000 0	104000 0	107000 0	47000 0	110000 0	66000 0	340000 0	14000 0
Chromium	--	--	--	--	--	--	33 0	21 0	98 0	21 0	710 0	21 0	5 0 B	85 0
Cobalt	--	--	--	--	--	--	3 9 B	2 3 B	4 2 B	4 7 B	15 0	3 8 B	--	3 8 B
Copper	--	--	--	--	--	--	16 0	24 0	49 0	23 0	52 0	13 0	3 8 B	54 0
Iron	--	--	150 0	56 0 B	--	1100 0	16900 0	21000 0	4000 0	17000 0	25000 0	14000 0	30000 0	23000 0
Lead	23 0	36 0	3 0 B	6 0	13 0	38 0	20 0	76 0	128 0	69 0	110 0	40 0	--	132 00
Magnesium	3400 0 B	35000 0	5000 0 B	13000 0	3300 0 B	4500 0 B	24000 0	10500 0	27000 0	23000 0	23000 0	30000 0	40000 0	7400 0
Manganese	4 7 B	110 0	11 0 B	27 0	3 9 B	40 0	5100 0	900 0	4500 0	400 0	1100 0	1800 0	260 0	1800 0
Mercury	1 3	1 1	1 3	1 3	1 3	1 2	--	--	0 2	0 1	0 2	0 3	--	0 1
Nickel	--	8 9 B	7 8 B	7 7 B	--	9 4 B	11 0	11 0 B	17 0	14 0 B	69 0	9 6	11 0 B	31 0

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX C
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Potassium	1400 0 B	7300 0	2500 0 B	6600 0	2600 0 B	3700 0 B	3100 0	680 0	1300 0	820 0 B	600 0 B	860 0 B	--	880 0
Selenium	--	--	--	--	--	--	4 6	--	--	--	--	--	--	--
Silver	--	--	--	--	--	--	2 0 B	--	--	--	2 8	--	--	--
Sodium	105000 0	59000 0	107000 0	121000 0	94000 0	96000 0	1600 0	440 0	660 0	960 0	480 0 B	580 0 B	000 B	240 0 B
Thallium	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Tin	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Vanadium	--	--	--	--	--	--	4 0	200 0	111 0	21 0	170 0	38 0	41 0	100 0
Zinc	--	16 0 B	--	--	--	--	14 0	500 0	156 0	160 0	160 0	77 0	41 0	--
Cyanide	--	--	--	--	--	--	1 0	--	--	--	11 7	--	4 2	--
Sulfide	--	170000 0	--	--	--	18000 0	--	--	--	--	--	--	--	--
Sulfate	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH (pH Units)	8 4	7 5	8 3	8 1	9 1	0 5	NT	NT	NT	NT	NT	NT	NT	NT
Conductivity (umhos/cm)	481 0	849 0	507 0	688 0	583 0	477 0	NT	NT	NT	NT	NT	NT	NT	NT
Temperature (°F)	53 2	52 5	53 7	53 6	53 0	50 7	NT	NT	NT	NT	NT	NT	NT	NT

SUMMARY OF GROUNDWATER, SEDIMENT, AND SOIL ANALYSIS
PART OF APPENDIX C
INTERLAKE SITE
CHICAGO, ILLINOIS
(Continued)

Media	Groundwater (ug/l) ¹						Sediment/Soil (ug/kg or mg/kg) ²							
Sampling Point	G-101 (ST-1D)	G-102 (ST-2D)	G-103 (ST-3D)	G-104 (ST-4D)	G-105 (SS-1D)	G-106 (SS-2D)	X-101	X-102	X-103	X-104	X-105	X-106	X-107	X-108
Date	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89	7/19/89
Notes: ¹ Units for groundwater are ug/l. ² Units for sediment/soil are ug/kg for organic parameters and mg/kg for inorganic parameters. “--” Means not detected. NT Not Tested R Rejected J Value is estimated D Value is from a dilution analysis B Compound detected in laboratory blank Results are from the CERCLA Screening Site Inspection Report, IEPA, Undated														

ORGANIC DATA QUALIFIERS

- U - Indicates compound was analyzed for but not detected.
- J - Indicates an estimated value. This flag is used either when estimating a concentration for tentatively identified compounds where a 1:1 response is assumed, or when the mass spectral data indicate the presence of a compound that meets the identification criteria but the result is less than the sample quantitation limit but greater than zero.
- C - This flag applies to pesticide results where the identification has been confirmed by GC/MS.
- B - This flag is used when the analyte is found in the associated blank as well as in the sample.
- E - This flag identifies compounds whose concentrations exceed the calibration range of the GC/MS instrument for that specific analysis. This flag will not apply to pesticide/PCB's analyzed by GC/EC methods.
- D - This flag identifies all compounds identified in an analysis at a secondary dilution factor.
- A - This flag indicates that a TIC is a suspected aldol-condensation product.
- X - Other specific flags and footnotes may be required to properly define the results. If used, they must be fully described and such description attached to the Sample Data Summary Package and the Case Narrative.

INORGANIC DATA QUALIFIERS

C (Concentration) Qualifier:

- B - Indicates the reported value is less than the Contract Required Detection Limit (CRDL) but greater than the Instrument Detection Limit (IDL).
- U - Indicates compound was analyzed for but not detected.

Q Qualifier:

- E - The reported value is estimated because of the presence of interference.
- M - Duplicate injection precision not met.
- N - Spiked sample recovery not within control limits.
- S - The reported value was determined by the Method of Standard Additions (MSA).
- W - Post-digestion spike for Furnace AA analysis is out of control limits (85-115%), while the sample absorbance is less than 50% of spike absorbance.
- * - Duplicate analysis not within control limits.
- + - Correlation coefficient for the MSA is less than 0.995.

M (Method) Qualifier Enter:

- "P" for ICP
- "A" for Flame AA
- "F" for Furnace AA
- "CV" for Manual Cold Vapor AA
- "AV" for Automated Cold Vapor AA
- "AS" for Semi-Automated Spectrophotometric
- "C" for Manual Spectrophotometric
- "T" for Titrimetric
- "NR" if the analyte is not required to be analyzed.



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Project #: 931319
C.O.C. #: 14501
Date : 08/18/93

Rust Environment & Infrastructure, Inc.
1240 E. Diehl Road
Naperville, IL 60563

ATTN: Bud Schultz

Sampling Date: 08/04/93
Analyses Date: 08/05-18/93

Identification: Twelve samples taken by Bud Schultz identified
as:

INTERLAKE

Results follow:

TOTAL Cyanide and
REACTIVE Cyanide Analyses
Method: SW846 9010 & 7.3.3.2

<u>Sample ID: 931319-01-10</u>			<u>PQL (mg/L)</u>	<u>Total Cyd. Analysis</u>	<u>Reactive Cyd. Analysis</u>
No.01	SW-4-L	0.02	ND	ND	
No.02	SW-4-I	0.02	ND	ND	
No.03	SW-4-R	0.02	ND	ND	
No.04	SW-4-S	0.02	ND	ND	
No.05	SW-12-S	0.02	0.2	*	
No.06	SW-12-R	0.02	0.2	ND	
No.07	SW-12-L	0.02	0.3	ND	
No.08	SW-12-1	0.02	0.05	ND	
No.09	SW-4-Soil	0.02 mg/Kg	6.1	ND	
No.10	SW-18-Soil	0.02 mg/Kg	1.8	ND	
No.11	Trip Blank (H ₂ O)	0.02 mg/L	ND	ND	
No.12	Trip Blank(Soil)	0.02 mg/Kg	ND	ND	

*Note: Non-Conformance Report (NCR) - Insufficient sample to complete test.

ND = Not Detected at or above the PQL
PQL = Practical Quantitation Limit

Respectfully submitted,

Paulius T. Alekna
Paulius (Paul) T. Alekna
Lab Director
Quality Analytical Labs, Inc.

sy:RU931319

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NON-CONFORMANCE REPORT

Non-Conformance Report ID : NCR -

Date : 8/18

Section 1 - Project Information

Client Identification : RUST

QAL Identification : ~~RUST~~ 931319

COC Identification :

Analytical Parameter : CN

Method : SW-846 7.3.3.2

Sample(s) Affected : 05

Section 2 - Description of Non-Conformance

Occurance First ☐ Second ☐ Third ☐

Surrogate Identification(s) :

☐ Surrogate recovery outside QA/QC limits due to matrix effect☐ Surrogate recovery outside QA/QC limits. HIGH ☐ LOW ☐

Specify :

☐ Internal standard area counts outside of QA/QC limits due to matrix effect☐ Internal standard area counts outside of QA/QC limits

Specify :

☐ Other

Specify :

Section 3 - Non-Conformance Impact

05 - USED SAMPLE for ms + msd in addition
to using as regular sample when running TOTAL CR
Therefore had no sample left for Rx

Section 4 - Additional Comments

Section 5 - Supervisor's Comments

Section 6 - Non-Conformance Report Closure

Analyst(s) : VR

Date : 8/17

Reviewed : LAK

Date : 8/18



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Root E & R
Company Name
1240 E Diehl Rd
Address

9/17/19
Nº 14501

CHAIN OF CUSTODY RECORD

PROJECT NUMBER		PROJECT NAME				NO OF CON- TAINERS	REMARKS						
SAMPLERS (Signature) <u>BQ Subo</u>													
ITEM NO	STA NO	DATE	TIME	COMP.	GRAB	STATION LOCATION							
01	SW-4	8/4/23	12:35		X	SW-4-1	1	X	X				
02						SW-4-1	2						
03						SW-4-R	1						
04						SW-4-S	1						
05	SW-12		1400			SW-12-S	1						
06						SW-12-R	1						
07						SW-12-L	1						
08						SW-12-1	1						
09	SW-4		12:35			SW-4-Soil	2						
10	SW-12		1400			SW-12-Soil	1						
11						TRIP BLANK (HILL)	1						
12						TRIP BLANK (SILT)	1						
13													
14													
15													
Relinquished by: (Signature)				Date/Time		Received by: (Signature)		Relinquished by: (Signature)		Date/Time		Received by: (Signature)	
Relinquished by: (Signature)				Date/Time		Received by: (Signature)		Relinquished by: (Signature)		Date/Time		Received by: (Signature)	
Relinquished by: (Signature) <u>BQ Subo</u>				Date/Time 8/4/23 6:55		Received for Laboratory by: (Signature) <u>Amad</u>		Date/Time 8/4/23 6:55		Remarks			



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LABS, INC.

December 27, 1993

Mr. B. Schultz
Rust Inc.
1240 E. Diehl Rd. Suite 500
Naperville, IL 60563

Dear Mr. Schultz,

This letter is in response to your request that we explain in a bit more detail the detection limits we use generally and how they relate to those you require for your periodic testing.

We have recently recalibrated our cyanide test methods. This involves running several water samples with known low level cyanide concentrations through the test. We then use a statistical calculation on the results to derive the method detection limit. The result for waters in which 250mls of sample is used was 0.034 mg/L which mathematically could be rounded down to 0.3 but we rounded up to 0.04 mg/L for our water detection limit. This rounding up process is used to give us a bit of a "comfort zone" since real world samples are seldom as well behaved as the lab test samples used to determine detection limits as outlined by the EPA method.

Our soil detection limit is based on the fact that 20g of soil is used rather than 250mls (250g) for waters. Thus the detection limit for soils is:

$$0.034 \times 250/20 = 0.425 \text{ mg/kg}$$

Again this can be mathematically rounded down to 0.4 mg/kg but we normally round it up to 0.5 mg/kg to provide our "comfort zone" for real world samples.

In the case of your soil samples submitted under QAL project # 932245 we were unaware that you were looking for the specific target detection limit of 0.4 mg/kg for soils so we proceeded to run and report the cyanide results in our normal fashion. Fortunately, our "comfort zone" does allow us to amend that report with detection limits of 0.4 mg/kg. This detection limit is correct and valid as defined by the method.

In the future, if you continue to require the target detection limit of 0.4 mg/kg on soils it would help us if you mark this on the incoming chain of custody and also inform your QAL sales representative. If it is marked, we will run 40g rather than 20g of your sample (including a matching 40g blank sample for comparison) and this will give you a detection limit of :

$$0.034 \times 250/40 = 0.2125 \text{ mg/kg}$$

We will round this up to a reported detection limit of 0.3 mg/kg, giving us our "comfort zone" while giving you

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a detection limit below your target requirements.

I hope this letter answers your concerns about our detection limits. Again I would like to emphasize that the detection values in our amended report are completely valid and defensible. If you have any further questions please feel free to contact me at any time.

Sincerely,

Douglas Weir, Ph.D.
QCO, Quality Analytical Labs



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Project #: 932245 Amended
C.O.C. #: 14494
Date: 12/28/93

Rust Environmental & Infrastructure
1240 E. Diehl Road
Naperville, IL 60563

Attn: Ralph Bonk

Sampling Date: 11/30/93
Analyses Date: 12/2-14/93

Identification: Thirteen samples taken by Bud. S. identified as:

INTERLAKE
PROJECT # 71136.100

Results follow:

Sample ID: SW-4-Shallow 932245-01

Parameter	PQL	Analysis	Method SW846
Reactive Cyanide	0.04 mg/L	U	7.3.3.2
Total Cyanide	0.04 mg/L	U	9010

Sample ID: SW-4-1 932245-02

Parameter	PQL	Analysis	Method SW846
Reactive Cyanide	0.04 mg/L	U	7.3.3.2
Total Cyanide	0.04 mg/L	U	9010

Sample ID: SW-4-1 Dup 932245-03

Parameter	PQL	Analysis	Method SW846
Reactive Cyanide	0.04 mg/L	U	7.3.3.2
Total Cyanide	0.04 mg/L	U	9010

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Sample ID: SW-4-Left 932245-04
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

Sample ID: SW-4-Right 932245-05
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

Sample ID: SW-4-Soil 932245-06
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.40 mg/Kg U 7.3.3.2
Total Cyanide 0.40 mg/Kg U 9010

Sample ID: SW-12-Shallow 932245-07
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

Sample ID: SW-12-1 932245-08
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

Sample ID: SW-12-Left 932245-09
Parameter PQL Analysis Method
SW846

Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

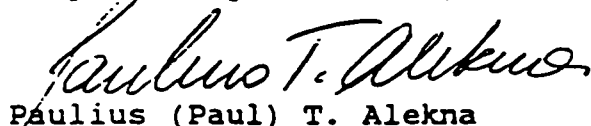
Sample ID: SW-12-Right 932245-10
Parameter PQL Analysis Method
SW846
Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

Sample ID: SW-12-Soil 932245-11
Parameter PQL Analysis Method
SW846
Reactive Cyanide 0.40 mg/Kg U 7.3.3.2
Total Cyanide 0.40 mg/Kg U 9010

Sample ID: Trip Blank H2O 932245-12
Parameter PQL Analysis Method
SW846
Reactive Cyanide 0.04 mg/L U 7.3.3.2
Total Cyanide 0.04 mg/L U 9010

Sample ID: Trip Blank Soil 932245-13
Parameter PQL Analysis Method
SW846
Reactive Cyanide 0.40 mg/Kg U 7.3.3.2
Total Cyanide 0.40 mg/Kg U 9010

Respectfully submitted,


Paulius (Paul) T. Alekna
Lab Director
Quality Analytical Labs, Inc.

ps:RU932245

EPA - Defined Data Qualifiers

- B** **Compound detected in blank (Normalized concentration)**
Used when blank value exceeds half of the CRDL (PQL).
- C** **Pesticide result confirmed by GC/MSD**
- D** **Compound identified in analysis at a secondary dilution factor**
Used when two or more dilutions of a sample are needed to acquire valid data.
- E** **Compounds concentration exceeds calibration range**
Used when upper level of calibration curve is exceeded by 10%. Analyses greater than 50% of upper calibration level are reanalyzed at a higher dilution.
- J** **Estimated value. Compound detected below the CRDL (PQL).**
- P** **Pesticide or Aroclor analysis where results between analytical and confirmation columns is > 25%.**
- U** **Compound analyzed for but not detected at or above the CRDL (PQL).**
- X** **NON-Specific flag - See definition at the end of the report**

Data Validation Qualifiers

- NJ** **Presumptive evidence of presence of material at an estimated quantity.**
Used when QA/QC failures are present AND data is true. Must be accompanied by NCR
- PND** **Precision Not Determined**
Used when non-approved methods are used to obtain data.
- R** **Reported value is unusable due to gross QA/QC deficiencies.**
- RND** **Recovery Not Determined**
Used when non-approved methods are used to obtain data.
- UJ** **Compound analyzed for but not detected, reported detection limit estimated because QA/QC criteria were not met.**

Detection Limit Definitions

- CRDL** **Contract Required Detection Limits = Detection limits specified by client or agency**
Based on wet weight analysis
- IDL** **Instrument Detection Limit**
Statistically derived detection limit from 7 + analyses of a low level standard near but above the estimated Method Detection Limit.
- MDL** **Method Detection Limit**
$$\text{Instrument Detection Limit} \times \text{End Volume (specified by the method)} / \text{Mass, Volume or Area of the Sample (specified by the method)} \text{ (Based on wet weight analysis)}$$
- PQL** **Practical Quantitation Limit**
$$\text{Method Detection Limit} \times \text{End Volume (analytical)} / \text{Mass, Volume or Area of the Sample (analytical)} \text{ (Based on wet weight analysis)}$$



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RUST E & I

Company Name

1240 E. Diehl Rd, Naperville, IL 60563

Address

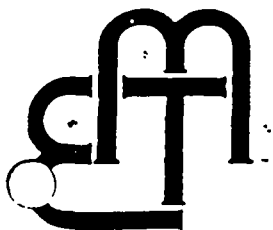
932245

N" 14494

CHAIN OF CUSTODY RECORD

PROJECT NUMBER		PROJECT NAME		NO. OF CONTAINERS		REMARKS											
7136.100		Interlake															
SAMPLERS (Signature)																	
BOS																	
ITEM NO.	STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	Total Granide	Reactive Granide									
1	SW-4	11/30/93	14:40		X	SW-4 - Shallow	X	X									(H ₂ O)
2						SW-4 - 1	X	X									
3						SW-4 - 1 Dup	X	X									
4						SW-4 - Left	X	X									
5						SW-4 - Right	X	X									
6	↓		↓			SW-4 - Soil	X	X									(SOIL)
7	SW-12		13:50			SW-12 - Shallow	X	X									(H ₂ O)
8	↓					SW-12 - 1	X	X									
9	↓					SW-12 - Left	X	X									
10	↓					SW-12 - Right	X	X									
11	↓	↓	↓			SW-12 - Soil	X	X									(SOIL)
12	Trip					Trip Blank (H ₂ O)	X	X									(H ₂ O)
13	Trip					Trip Blank (Soil)	X	X									(SOIL)
14																	
15																	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
	12/2/93 5:45	Ju. On			
Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks	
BOS	12/13/93 4:40	Frank W.			



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

92201

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Report Date: 3/14/94
Sample Received: 3/4/94

Project Name: Interlake
Sample Description: Water

Sample No.:	Location	Reactive Cyanide	Total Cyanide
75020	SW-4-1	<0.02	<0.02
75021	SW-4-Dup	<0.02	<0.02
75022	SW-4-Shallow	<0.02	<0.02
75023	SW-4-L	<0.02	<0.02
75024	SW-4-R	<0.02	<0.02
75026	SW-12-1	<0.02	<0.02
75027	SW-12-Shallow	<0.02	<0.02
75028	SW-12-L	<0.02	<0.02
75029	SW-12-R	<0.02	0.030

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

LABORATORY DIRECTOR



**ENVIRONMENTAL
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FAX: 708/967-6735

LABORATORY REPORT

92202

Rust. E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Report Date: 3/14/94
Sample Received: 3/4/94-

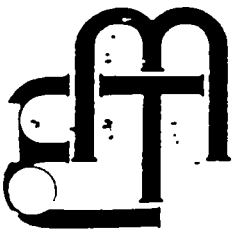
Project Name: Interlake
Sample Description: Soil

Sample No.:	Location	Reactive Cyanide	Total Cyanide
75025	SW-4-Soil	<0.2	1.91
75030	SW-12-Soil	0.29	1.94
75031	Blank-Soil	<0.11	0.101

All results expressed as ppm unless otherwise indicated.

Methods performed according to SW-846, "Test Methods for Evaluating Solid Waste".

LABORATORY DIRECTOR



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LABORATORY REPORT

92203

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Report Date: 3/14/94
Sample Received: 3/7/94

Project Name: Interlake
Sample Description: Water Blank
Sample No.: 75102

Reactive Cyanide	<0.02
Total Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Methods performed according to SW-846, "Test Methods for Evaluating Solid Waste".

LABORATORY DIRECTOR



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8100 North Austin Avenue
Morton Grove, Illinois 60053-3203

708-967-6666
FAX: 708/967-6735

Due Date: _____ COC #: **3448**

Company: Rust
Address: 1240 E Diehl Rd
NAPERVILLE, IL 60563
Phone #: 708-955-6795 Fax #: ()
P.O. #: _____ Proj. #: _____
Client Contact: Bud Schultz
Project ID / Location: Interlake

Sample Type: Container Type:

- | | |
|-----------------------------------|---------------------|
| 1. Water | P - Plastic |
| 2. Soil | G - Glass |
| 3. Sludge | V - VOC |
| 4. Oil | |
| 5. Waste | |
| Other: | |
| Preservative: | |
| 1. None | 3. HNO ₃ |
| 2. H ₂ SO ₄ | 4. NaOH |

Analyses

Sample I.D. (10 Characters ONLY)	Sample Type	Container			Sampling		Preservative	Lab I.D.	Total CN Reactive CN										Comments
		Size	Type	No.	Date	Time													
Sw-4-1	1	12	G	1	3/4/94	10:30	1	75020	X	X									
Sw-4-Dip	1							75021											
Sw-4-Shallow	1							75022											
Sw-4-L	1							75023											
Sw-4-R	1							75024											
Sw-4-Soil	2							75025											
Sw-12-1	1					10:45		75026											
Sw-12-Shallow	1							75027											
Sw-12-L	1							75028											
Sw-12-R	1							75029											
Sw-12-Soil	2	✓	✓	✓	✓	✓	✓	75030	✓	✓									
								75031											

EMT does not accept samples that contain high levels of Cyanide. ~~17~~

Relinquished By:	Date: -- -- Time: :	Received By:	Date: -- -- Time: :	Witness:	TURNAROUND TIME: <input type="checkbox"/> RUSH ____ day turnaround <input checked="" type="checkbox"/> ROUTINE
Relinquished By: <u>BOS</u>	Date: <u>3-4-94</u> Time: :	Received For Lab By: <u>Anthony</u>	Date: <u>3-4-94</u> Time: <u>21:00</u>		



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LABORATORY REPORT

101784

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-4-1
Sample No.: S7154

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.011
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

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Morton Grove, Illinois 60053-3203
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LABORATORY REPORT

101785

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-4-Shallow
Sample No.: 87155

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.010
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

Gary W. Wiegman

LABORATORY DIRECTOR



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101786

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-4-L
Sample No.: 37156

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.008
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

Gary W. Wiegman



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
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708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101787

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-4-R
Sample No.: 87157

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.008
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

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708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101793

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Soil - SW-4-Soil
Sample No.: 87158

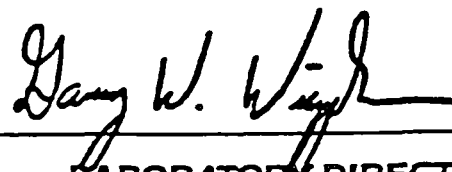
Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	3.37
Reactive Cyanide	0.03

All results expressed as ppm unless otherwise indicated.

Methods performed according to SW-846, "Test Methods for Evaluating Solid Waste".

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.



LABORATORY DIRECTOR



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC

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Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101788

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-12-1
Sample No.: 87159

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.012
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101789

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-12-Shallow
Sample No.: 87160

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.011
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR



ENVIRONMENTAL MONITORING AND TECHNOLOGIES, INC.

8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101791

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-12-R
Sample No.: 87162

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide . 0.011

Reactive Cyanide <0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

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Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101790

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-12-L
Sample No.: 87161

Report Date: 7/21/94
Sample Received: 7/7/94

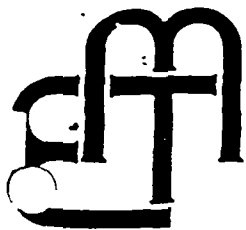
Total Cyanide	0.009
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

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708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101794

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Soil - SW-12-Soil
Sample No.: S7163

Report Date: 7/21/94
Sample Received: 7/7/94

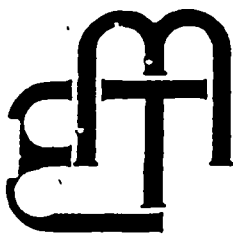
Total Cyanide	2.81
Reactive Cyanide	0.23

All results expressed as ppm unless otherwise indicated.

Methods performed according to SW-846, "Test Methods for Evaluating Solid Waste".

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR



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8100 North Austin Avenue
Morton Grove, Illinois 60053-3203
708/967-6666
FAX: 708/967-6735

LABORATORY REPORT

101792

Rust E&I
1240 E. Diehl Rd.
Naperville, IL 60563

Project Name: Interlake
Sample Description: Wastewater Grab - SW-12-1 Dup
Sample No.: 87164

Report Date: 7/21/94
Sample Received: 7/7/94

Total Cyanide	0.008
Reactive Cyanide	<0.02

All results expressed as ppm unless otherwise indicated.

Analyses performed using "Standard Methods for the Examination of Water and Wastewater", 17th Edition.

The contents of this report apply only to the sample analyzed. No duplication of this report is allowed except in its entirety.

LABORATORY DIRECTOR

APPENDIX D
IEPA REMEDIATION OBJECTIVES

PROPOSED PART 742 RULES

DISCLAIMER

The proposed rules under 35 Ill. Adm. Code 742 are draft rules that have not yet gone through the rulemaking process pursuant to the Illinois Administrative Procedure Act. Because the rules have not yet been proposed to the Illinois Pollution Control Board or gone through the notice and hearing process, they do not have any force or effect in law.

The Agency will be proposing the Part 742 rules to the Board sometime between July 1 and September 15, 1996. However, it is the Agency's intention to propose the rules to the Board the beginning of July 1996. Currently, the only authority the Agency has to utilize the Part 742 rules is by way of an "alternative methodology" set forth in various program-specific regulations.

4/8/96 DRAFT

TITLE 35: ENVIRONMENTAL PROTECTION

SUBTITLE G: WASTE DISPOSAL

CHAPTER I: POLLUTION CONTROL BOARD

SUBCHAPTER f: RISK BASED CLEANUP OBJECTIVES

PART 742

TIERED APPROACH TO CLEANUP OBJECTIVES

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742.105	Applicability
742.110	Overview of Tiered Approach
742.115	Key Elements
742.120	Site Characterization

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742.1005 Engineered Barrier Requirements

742.APPENDIX A General

Table A Soil Saturation Limits (C_{sat}) for Chemicals Whose Melting Point is Less Than 30°C

Table B Tolerance Factor (K)

Table C SSL Chemicals with Noncarcinogenic Toxic Effects on Specific Target Organs/Organ Systems or Similar Modes of Action

Illustration A Illinois Metropolitan Statistical Areas

Illustration B Developing Tiered Cleanup Objectives for Soil

Illustration C Developing Tiered Cleanup Objectives for Groundwater

742.APPENDIX B Tier 1 Tables and Illustrations

Table A Tier 1 Soil Cleanup Objectives for Residential Properties

Table B Tier 1 Soil Cleanup Objectives for Industrial/Commercial Properties

Table C pH Specific Soil Cleanup Objectives for Inorganics and Ionizing Organics for Protection Of Class I Groundwater

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Table E Tier 1 Groundwater Cleanup Objectives

Illustration A Tier 1 Evaluation

742.APPENDIX C Tier 2 Tables and Illustrations

Table A SSL Equations

Table B SSL Parameters

Table C RBCA Equations

Table D RBCA Parameters

Table E Default Physical and Chemical Parameters

Table F Methods for Determining Physical Soil Parameters

Table G Error Function (erf)

Illustration A Tier 2 Evaluation for Soil

Illustration B Tier 2 Evaluation for Groundwater

742.APPENDIX D Procedures for Determination of Class II Groundwater

AUTHORITY: Implementing Sections 22.4, 22.12, 57-57.17, and 58.1-58.12 and authorized by Sections 27, 57.14, and 58.5 of the Environmental Protection Act [415 ILCS 5/22.4, 22.12, 57-57.17, 57.14, and 58.5] (see P.A. 88-496, effective September 13, 1993 and P.A. 89-0431, effective December 15, 1995).

SOURCE:

NOTE: Capitalization indicates statutory language.

SUBPART A: INTRODUCTION

Section 742.100

Intent and Purpose

- a) This Part sets forth a tiered procedure for use in developing soil and groundwater cleanup objectives. The purpose of this procedure is to provide for the adequate protection of human health and the environment while incorporating site-related information, to the extent practicable, which may allow for more cost-effective site remediation.
- b) The tiered procedure provided in this Part allows a person remediating a site to evaluate land use, site-specific soil and groundwater characteristics, institutional controls, and engineered barriers in developing cleanup objectives. Under this procedure a site can qualify to receive a "No Further Remediation" determination under any of the three tiers; however, certain restrictions on site use or management may be required to assure protection of human health and the environment. This Part also describes how background levels can be used as cleanup objectives.
- c) Actions which can be taken to achieve cleanup objectives established in accordance with the tiered procedure include:
 - 1) Reduction of contaminant concentrations through conventional methods (e.g., dig and haul, in-situ treatment, ex-situ treatment, etc.) to meet the cleanup objectives;
 - 2) Use of management techniques to restrict exposure to the contaminated soil or groundwater or both (e.g., engineered barriers and institutional controls);
 - 3) No action, if the contaminant concentrations present at the site do not exceed the cleanup objectives; and
 - 4) Any combination of subsections (c) (1), (c) (2), or (c) (3) of this Section.

Section 742.105

Applicability

- a) Any person may elect to proceed under this Part to the extent allowed by State and federal law and regulations and the provisions of this Part. In the event of a conflict between the provisions of this Part and other State or federal requirements, those requirements shall

control.

- b) This Part may not be used without following the procedures and requirements applicable to the specific program under which remediation is being performed. Examples of the programs include the following:
 - 1) Leaking Underground Storage Tanks (35 Ill. Adm. Code 731 and 732);
 - 2) Site Remediation Program (35 Ill. Adm. Code 740); and
 - 3) RCRA Part B Permits and Closure Plans Corrective Action (35 Ill. Adm. Code 724 and 725).
- c) The procedures in this Part may not be used if their use would delay response action when timeliness is critical to address imminent and substantial threats to human health and the environment. This Part may only be used after actions to address such threats have been completed.
- d) This Part may not be used to develop cleanup objectives for surface waters, sediments, or ecological concerns.
- e) A "No Further Remediation" determination issued by the Agency prior to the effective date of this Part shall remain in effect in accordance with the terms of the determination.

Section 742.110 Overview of Tiered Approach

- a) This Part sets forth three tiers for use in developing site-specific cleanup objectives (see Appendix A, Illustrations B and C). A person remediating a site has the option of selecting which tier or combination of tiers shall be used to develop cleanup objectives. Tier 1 evaluations and Tier 2 evaluations are not prerequisites to conduct Tier 3 evaluations.
- b) Tier 1. A Tier 1 evaluation compares the concentration of contaminants detected at a site to baseline contaminant cleanup objectives contained in Appendix B, Tables A and B. To complete a Tier 1 evaluation, a person must know the extent and concentrations of the contaminants of concern, the groundwater class, and the land use classification at the site. If cleanup objectives are developed based on industrial/commercial use, then institutional controls under Subpart I are required.

- c) Tier 2. A Tier 2 evaluation requires the same type of information that is required for a Tier 1 comparison (i.e., extent and concentrations of the contaminants of concern, the groundwater class, and the land use classification at the site). Under Tier 2, however, additional site related information is used in the equations listed in Appendix C, Tables A and C. This additional Tier 2 information may allow for the calculation of less stringent, but equivalently protective cleanup objectives. Tier 2 also considers the use of institutional controls and engineered barriers in accordance with Subparts I and J respectively.
- d) Tier 3. A Tier 3 evaluation allows alternative parameters and factors, not available under a Tier 1 evaluation or a Tier 2 evaluation, to be considered. A Tier 3 evaluation can be simple or complex depending on the remediation method and the site conditions.
- e) After development of cleanup objectives under any of the three tiers set forth in Subparts D through H the site may be remediated to those cleanup objectives. When contaminant concentrations do not exceed cleanup objectives under one of the tiers, evaluation under any of the other tiers is not required.

Section 742.115 Key Elements

To develop cleanup objectives under this Part, the following key elements shall be addressed.

- a) Exposure Routes
 - 1) This Part identifies the following as potential exposure routes to be addressed:
 - A) Inhalation of vapors and particulates;
 - B) Ingestion of soil;
 - C) Groundwater and migration to groundwater; and
 - D) Dermal contact.
 - 2) The evaluation of inhalation, ingestion, groundwater and migration to groundwater is required for all sites when developing cleanup objectives. Evaluation of the dermal exposure route is required for use of RBCA equations in Appendix C, Table C or use of formal risk assessment under Section 742.815.

b) Receptors

- 1) Under Tier 1, the receptor information required is limited to the identification of land use.
- 2) Tier 2 and 3 evaluations generally require a characterization of the receptors potentially impacted by the contaminants of concern at a site by defining the location and activities of human receptors at and around the site. The types of human receptors to be evaluated include persons who live in the area (i.e., residential receptors), persons who work in the area (i.e., industrial/commercial receptors), and persons who provide services to businesses in the area (i.e., construction workers). Depending upon present and future land uses, agricultural (crops and livestock) and wildlife receptors may need to be evaluated under Tier 3.

c) Contaminants of Concern

- 1) The contaminants of concern to be remediated depend on the following:
 - A) The materials and wastes managed at the site;
 - B) The extent of the determination being requested from the Agency; and
 - C) The requirements applicable to the specific program under which the remediation is being performed.
- 2) If the goal is to obtain a "No Further Remediation" determination for an entire site, it may be important to investigate historical operations at the site and the types of materials managed on-site. However, if the goal is to address a class of contaminants (e.g., unleaded gasoline released from storage tanks) or a specific unit at a facility (e.g., drum storage area), then it is only necessary to address those contaminants or units for which the determination is being requested.

d) Land Use

The present and future uses of the site where exposures may occur shall be evaluated. The land use of a site, or portion thereof, shall be classified as one of the following:

- 1) Residential property;
- 2) Conservation property;
- 3) Agricultural property; or
- 4) Industrial/commercial property.

e) Groundwater Classification

Except as provided in Subpart G and Appendix D, the requirements set forth in 35 Ill. Adm. Code 620 relative to groundwater classification shall apply in developing groundwater cleanup objectives under this Part.

Section 742.120 Site Characterization

- a) Characterization of the extent and concentrations of contamination at a site shall be performed before beginning development of cleanup objectives. The actual steps and methods taken to characterize a site are determined by the requirements applicable to the program under which the characterization is performed. Site characterization typically includes the following:
 - 1) Characterization of contaminant sources, identifying:
 - A) The major sources of contamination;
 - B) The contaminants of concern and any potential degradation products;
 - C) Regulatory classification of contaminated materials in media; and
 - D) Results of sampling, analyses, and field screening measurements indicating the concentrations of contamination present in the source area.
 - 2) Characterization of present and future exposure routes, identifying:
 - A) The location of any human and environmental receptors; and
 - B) Present and future uses of impacted or potentially impacted land, groundwater, surface water, and sensitive habitats.

- 3) Characterization of the extent of contamination, identifying:
 - A) The actual contaminated medium or media of concern;
 - B) The three-dimensional configuration of contamination with concentrations exceeding the Tier 1 concentrations delineated; and
 - C) The nature, direction, and rate of movement of contaminants of concern.
 - 4) Characterization of significant physical features of the site and vicinity.
- b) The level of detail required to characterize a site for developing cleanup objectives under this Part is dependent upon the tier used. Use of Tier 1 objectives requires the least site-specific information. Development of Tier 2 or Tier 3 objectives requires additional site-specific information as provided in Subparts E through H.

SUBPART B: GENERAL

Section 742.200 Definitions

Except as stated in this Section, or unless a different meaning of a word or term is clear from the context, the definition of words or terms in this Part shall be the same as that applied to the same words or terms in the Illinois Environmental Protection Act [415 ILCS 5].

"Act" means the Illinois Environmental Protection Act [415 ILCS 5].

"ADL" means Acceptable Detection Limit, which is the detectable concentration of a substance which is equal to the lowest appropriate Practical Quantitation Limit (PQL) or Estimated Quantitation Limit (EQL) as published in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," USEPA Publication Number SW-846, as incorporated by reference in Section 742.210.

"Agency" means the Illinois Environmental Protection Agency.

"Agricultural Property" means any real property for which present or future use is planned to consist of the growing of agricultural crops for food or feed either as harvested crops, cover crops, or as pasture. This definition includes, but is not limited to, properties used for

confinement or grazing of livestock or poultry and for silviculture operations. Excluded from this definition are farm residences, farm outbuildings, and agrichemical facilities.

"Area Background" means CONCENTRATIONS OF REGULATED SUBSTANCES THAT ARE CONSISTENTLY PRESENT IN THE ENVIRONMENT IN THE VICINITY OF A SITE THAT ARE THE RESULT OF NATURAL CONDITIONS OR HUMAN ACTIVITIES, AND NOT THE RESULT SOLELY OF RELEASES AT THE SITE (Section 58.2 of the Act).

"ASTM" means the American Society for Testing and Materials.

"Attenuation" means a chemical constituent's tendency to be adsorbed during transport.

"Board" means the Illinois Pollution Control Board.

"Cancer Risk" means a unitless probability of an individual developing cancer from a defined exposure rate and frequency.

"Cap" means a barrier designed to prevent the infiltration of precipitation or other surface water, or impede the ingestion or inhalation of contaminants.

"Carcinogen" means A CONTAMINANT THAT IS CLASSIFIED AS A CATEGORY A1 OR A2 CARCINOGEN BY THE AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS; OR A CATEGORY 1 OR 2A/2B CARCINOGEN BY THE WORLD HEALTH ORGANIZATIONS INTERNATIONAL AGENCY FOR RESEARCH ON CANCER; OR A "HUMAN CARCINOGEN" OR "ANTICIPATED HUMAN CARCINOGEN" BY THE UNITED STATES DEPARTMENT OF HEALTH AND HUMAN SERVICE NATIONAL TOXICOLOGICAL PROGRAM; OR A CATEGORY A OR B1/B2 CARCINOGEN BY THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY IN INTEGRATED RISK INFORMATION SYSTEM OR A FINAL RULE ISSUED IN A FEDERAL REGISTER NOTICE BY THE USEPA.

"Class I Groundwater" means groundwater that meets the Class I: Potable Resource Groundwater criteria set forth in 35 Illinois Administrative Code 620.

"Class II Groundwater" means groundwater that meets the Class II: General Resource Groundwater criteria set forth in 35 Illinois Administrative Code 620.

"Class III Groundwater" means groundwater that meets the Class III: Special Resource Groundwater criteria set forth in 35 Illinois Administrative Code 620.

"Conservation Property" means any real property for which present or future use is primarily for wildlife habitat.

"Construction Worker Scenario" means a situation where persons are engaged on a temporary basis to perform work involving construction activities including, but not limited to, personnel performing demolition, earth-moving, building, and routine and emergency utility instillation or repair activities.

"Contaminant of Concern (COC) or Regulated Substance of Concern" means ANY CONTAMINANT THAT IS EXPECTED TO BE PRESENT AT THE SITE BASED UPON PAST AND CURRENT LAND USES AND ASSOCIATED RELEASES THAT ARE KNOWN TO THE person conducting a remediation BASED UPON REASONABLE INQUIRY. (Section 58.2 of the Act)

"Engineered Barrier" means a man-made barrier constructed to limit exposure to contaminants.

"Exposure Route" means a combination of a contaminant source(s), contaminant transport mechanism(s), and receptor(s).

"Free Product" means a contaminant that is present as a non-aqueous phase liquid for chemicals whose melting point is less than 30° C (e.g., liquid not dissolved in water).

"GROUNDWATER" MEANS UNDERGROUND WATER WHICH OCCURS WITHIN THE SATURATED ZONE AND GEOLOGIC MATERIALS WHERE THE FLUID PRESSURE IN THE PORE SPACE IS EQUAL TO OR GREATER THAN ATMOSPHERIC PRESSURE. (Section 3.64 of the Act)

"Groundwater Quality Standards" means the standards for groundwater as set forth in 35 Illinois Administrative Code 620.

"Hazard Quotient" means the ratio of a single substance exposure level during a specified time period to a reference dose for that substance derived from a similar exposure period.

"Health Advisory" means a health advisory issued under 35 Illinois Administrative Code 620, Subpart F.

"Industrial/Commercial Property" means any real property that does not meet the definition of residential property, conservation property, or agricultural property.

"Infiltration" means the amount of water entering the ground.

"Institutional Control" means a legal mechanism for imposing a restriction on land use.

"Negative Easement" means a right in owner of the dominant tenement to restrict the owner of the servient tenement in exercise of general and natural rights of property (Black's Law Dictionary, fifth edition).

"Person" means an INDIVIDUAL, TRUST, FIRM, JOINT STOCK COMPANY, JOINT VENTURE, CONSORTIUM, COMMERCIAL ENTITY, CORPORATION (INCLUDING A GOVERNMENT CORPORATION), PARTNERSHIP, ASSOCIATION, STATE, MUNICIPALITY, COMMISSION, POLITICAL SUBDIVISION OF A STATE, OR ANY INTERSTATE BODY INCLUDING THE UNITED STATES GOVERNMENT AND EACH DEPARTMENT, AGENCY, AND INSTRUMENTALITY OF THE UNITED STATES. (Section 58.2 of the Act)

"Pump Test" means a test in which water is removed from a well at a constant rate for a specified time and the return of the water level to its original position is plotted against time.

"RBCA" means Risk Based Corrective Action as defined in ASTM E-1739-95, as incorporated by reference in Section 742.210.

"RCRA" means the Resource Conservation and Recovery Act of 1976 (as amended) (42 U.S.C. Sec. 6921 et seq.)

"Receptor" means an organism present or potentially present at the point of exposure.

"Reference Concentration" means an estimate of a daily exposure, in units of milligrams of chemical per cubic meter of air (mg/m^3), to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious effects during a lifetime.

"Reference Dose (RfD)" means an estimate of a daily exposure, in units of milligrams of chemical per kilogram of body weight per day ($\text{mg}/\text{kg}/\text{d}$), to the human population (including sensitive sub-groups) that is likely to be without appreciable risk of deleterious effects during a lifetime.

"Regulated Substance" means ANY HAZARDOUS SUBSTANCE AS DEFINED UNDER SECTION 101(14) OF THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (P.L. 96-510) AND PETROLEUM PRODUCTS INCLUDING CRUDE OIL OR ANY FRACTION THEREOF, NATURAL GAS, NATURAL GAS LIQUIDS, LIQUEFIED NATURAL GAS, OR SYNTHETIC GAS USABLE FOR FUEL (OR MIXTURES OF NATURAL GAS AND SUCH SYNTHETIC GAS). (Section 58.2 of the Act)

"Residential Property" means any real property that is used for habitation by individuals or properties where children

have the opportunity for exposure to contaminants through ingestion or inhalation at educational facilities, health care facilities, child care facilities, or playgrounds.

"Restrictive Covenant or Deed Restriction" means a provision placed in a deed limiting the use of the property and prohibiting certain uses. (Black's Law Dictionary, 5th Edition)

"Site" means ANY SINGLE LOCATION, PLACE, TRACT OF LAND OR PARCEL OF PROPERTY, OR PORTION THEREOF, INCLUDING CONTIGUOUS PROPERTY SEPARATED BY A PUBLIC RIGHT-OF-WAY. (Section 58.2 of the Act)

"Slurry Wall" means a man-made barrier made of geologic material which is constructed to prevent or impede the movement of contamination into a certain area.

- "Soil Saturation Limit (C_{sat})" means the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached. Above this concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required.

"SSL" means Soil Screening Levels as defined in USEPA's Draft Soil Screening Guidance incorporated by reference in Section 742.210.

"Solubility" means a chemical specific maximum amount of solute that can dissolve in a specific amount of solvent (groundwater) at a specific temperature.

"TCLP" means Toxicity Characteristic Leaching Procedure (Method 1311) as published in "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," U.S. EPA Publication number SW-846, as incorporated by reference in 35 Ill. Adm. Code 742.210.

"Total Petroleum Hydrocarbon (TPH)" means the additive total of all petroleum hydrocarbons found in an analytical sample.

"Volatile Organic Compounds (VOCs)" means organic chemical analytes identified as volatiles in USEPA SW-846 (incorporated by reference in Section 742.210) method numbers 8010, 8011, 8015, 8020, 8021, 8030, 8031, 8240, 8060, 8315, and 8316. For analytes not listed in any category in those methods, those analytes which have a boiling point less than 200°C and a vapor pressure greater than 0.1 Torr

(mm Hg) at 20°C.

Section 742.205 Severability

If any provision of this Part or its application to any person or under any circumstances is adjudged invalid, such adjudication shall not affect the validity of this Part as a whole or any portion not adjudged invalid.

Section 742.210 Incorporations by Reference

- a) The Board incorporates the following material by reference:

ASTM. American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103 (215) 299-5400

ASTM D 2974-87, Test for Moisture, Ash and Organic Matter of Peat and Other Organic Materials. Approved May 29, 1987. Vol. 04.08.

ASTM E 1527-93, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, approved March 15, 1993. Vol. 11.04.

ASTM E 1739-95, Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites, approved September 10, 1995.

Barnes, Donald G. and Dourson, Michael. (1988). Reference Dose (RfD): Description and Use in Health Risk Assessments. *Regulatory Toxicology and Pharmacology*. 8, 471-486.

GPO. Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20401, (202) 783-3238.

USEPA Guidelines for Carcinogenic Risk Assessment, 51 Fed. Reg. 33992-34003, (September 24, 1986).

"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," U.S. EPA Publication number SW-846 (Third Edition, November, 1986), as amended by Updates I and IIA (Document Number 955-001-00000-1) (contact U.S. EPA, Office of Solid Waste, or MICE, as indicated below, for Update IIA).

IRIS. Integrated Risk Information System, National Center for Environmental Assessment, U.S. Environmental Protection Agency, 26 West Martin Luther King Drive,

MS-190, Cincinnati, Ohio 45268 (513) 569-7254.

"Reference Dose (RfD): Description and Use in Health Risk Assessments", Background Document 1A, (March 15, 1993).

"EPA Approach for Assessing the Risks Associated with Chronic Exposures to Carcinogens", Background Document 2, (January 17, 1992).

Nelson, D.W., and L.E. Sommers. 1982. Total carbon, organic carbon, and organic matter. In: A.L. Page (ed.), *Methods of Soil Analysis. Part 2. Chemical and Microbiological Properties*. 2nd Edition, 9(2):539-579, American Society of Agronomy. Madison, WI.

NTIS. National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, (703) 487-4600.

"Dermal Exposure Assessment: Principals and Applications", EPA Publication No. EPA/600/8-91/011B, (January 1992).

"Exposure Factors Handbook", EPA Publication No. EPA/600/8-89/043, (July 1989).

"Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors", OSWER Directive 9285.6-03, (March 1991).

"Risk Assessment Guidance for Superfund, Volume I; Human Health Evaluation Manual (Part A)", Interim Final, EPA Publication No. EPA/540/1-89/002, (December 1989).

"Risk Assessment Guidance for Superfund, Volume I; Human Health Evaluation Manual, Supplemental Guidance, Dermal Risk Assessment Interim Guidance", Draft, (August 18, 1992).

"Superfund Exposure Assessment Manual", EPA Publication No. EPA/540/1-88/001, (April 1988).

"Technical Background Document for Soil Screening Guidance," Review Draft, EPA Publication No. EPA 540/R-94/106 (November 1994), Doc. No. PB 95-963532.

RCRA Facility Investigation Guidance, Interim Final, developed by USEPA (EPA 530/SW-89-031), 4 volumes, May 1989.

- b) CFR (Code of Federal Regulations). Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (202) 783-3238

40 CFR 761.120 (1993).

- c) This Section incorporates no later editions or amendments.

Section 742.215 Applicable Risk Levels

The development of cleanup objectives requires the specification of acceptable health risk values associated with the concentrations of contaminants allowed to remain in the soil or groundwater.

- a) For carcinogenic soil contaminants the baseline target human cancer risk shall not exceed 1 in 1,000,000. With the use of institutional controls and engineered barriers in accordance with Subparts I and J respectively, the target human cancer risk may be increased to 1 in 10,000 in a Tier 2 or Tier 3 evaluation.
- b) For groundwater contaminants, the baseline cleanup objectives are based on standards and health advisory procedures as set forth in 35 Ill. Adm. Code 620. For carcinogens, these levels are not necessarily equivalent to a 1 in 1,000,000 target human cancer risk.
- c) For non-carcinogenic soil contaminants, a hazard quotient of one (1) shall not be exceeded.

Section 742.220 Determination of Soil Attenuation Capacity

- a) The concentrations of organic contaminants of concern remaining in the soil shall not exceed the attenuation capacity of the soil, as determined under subsection (b) of this Section.
- b) The soil attenuation capacity is not exceeded if:
- 1) The sum of all organic contaminant residual concentrations analyzed, at each discrete sampling point, is less than the natural organic carbon fraction of the soil. The natural organic carbon fraction (foc) shall be either:
- A) A default value of 6000 mg/kg for soils within the top meter and 2000 mg/kg for soils below one meter of the surface; or

- B) A site-specific value as measured by ASTM D2974-87 or Nelson and Sommers, as incorporated by reference in Section 742.210.
- 2) The total petroleum hydrocarbon concentration is less than the natural organic carbon fraction of the soil; or
- 3) Another method, approved by the Agency, shows that the soil attenuation capacity is not exceeded.

Section 742.225 Determination of Soil Saturation Limit

- a) For any organic contaminant that has a melting point below 30°C, the cleanup objective for the inhalation exposure route developed under Tier 2 or Tier 3 shall not exceed the soil saturation limit, as determined under subsection (c) of this Section.
- b) For any organic contaminant, the cleanup objective under Tier 2 or Tier 3 for the migration to groundwater exposure route shall not exceed the soil saturation limit, as determined under subsection (c) of this Section.
- c) The soil saturation limit shall be:
 - 1) The value listed in Appendix A, Table A for that specific contaminant;
 - 2) A value derived from Equation S14 in Appendix C, Table A; or
 - 3) A value derived from another method approved by the Agency.
- d) Under Tier 3, an evaluation approved by the Agency shows that exceedance of soil saturation limits does not invalidate the results of an alternative model approved by the Agency under Section 742.810.

Section 742.230 Determination of Compliance with Cleanup Objectives

- a) Compliance with groundwater cleanup objectives developed under Subparts C through H shall be determined by comparing the contaminant concentrations of discrete samples at each sample point to the applicable groundwater cleanup objective. Compliance is achieved if each sample result does not exceed the respective cleanup objective.

- b) Unless the person elects to composite samples or average sampling results as provided in subsections (c) and (d) of this Section, compliance with soil cleanup objectives developed under Subparts C through H shall be determined by comparing the contaminant concentrations of discrete samples to the applicable soil cleanup objective. Compliance is achieved if each sample result does not exceed that respective cleanup objective.
- 1) Except as provided in subsections (c) and (d) of this Section, compositing of samples is not allowed.
 - 2) Except as provided in subsection (c) and (d) of this Section, averaging of sample results is not allowed.
 - 3) Notwithstanding subsections (c) and (d) of this Section, compositing of samples and averaging of sample results is not allowed for the construction worker scenario.
 - 4) The number of sampling points required to demonstrate compliance is determined by the requirements applicable to the program under which remediation is performed.
- c) If a person chooses to composite samples or average sample results to determine compliance relative to the migration to groundwater route, the following procedures describing the minimum requirements apply.
- 1) A minimum of two sampling locations for every 0.5 acre is required. At each sample location discrete samples shall be obtained at every two feet of depth, beginning at six inches below the ground surface and continuing through the zone of contamination. Samples obtained at or below the water table shall not be used in compositing or averaging.
 - 2) For contaminants of concern other than volatile organic contaminants:
 - A) Discrete samples from the same boring may be composited.
 - B) Discrete sample results from the same boring may be averaged.
 - 3) For volatile organic contaminants:

- A) Compositing of samples is not allowed.
- B) Averaging of sample results from discrete samples from the same sample location boring is allowed.
- 4) For purposes of calculating averages under this subsection, sample results reported as "non-detect", "no contamination", "below detection limits", or similar terms shall be included in the averaging calculation as one-half of the reported analytical detection limit for the contaminant.
- d) If a person chooses to composite samples or average sample results to determine compliance relative to the inhalation or ingestion routes, the following procedures describing the minimum requirements apply.
 - 1) Unless an alternative method is approved by the Agency based on an appropriate statistically designed site-specific evaluation, a minimum of twenty samples per 0.5 acre, to be collected within the area of contamination, are required. Each discrete sample shall be obtained at a depth of one foot or less.
 - 2) For contaminants of concern other than volatile organic contaminants:
 - A) Each 0.5 acre portion of a site may be divided into quadrants of equal size and shape. The samples within the quadrant may be composited. The Agency may approve alternative quadrant geometry.
 - B) Averaging of sample results taken from separate quadrants is not allowed.
 - 3) For volatile organic contaminants neither compositing of samples nor averaging of sample results is allowed.

Section 742.235 Agency Review and Approval

- a) Documents and requests filed with the Agency under this Part shall be submitted in accordance with the procedures applicable to the program under which remediation is performed.
- b) Agency review and approval of documents and requests under this Part shall be performed in accordance with the procedures applicable to the program under which

the remediation is performed (e.g., 35 Ill. Adm. Code 732, Subpart E for petroleum leaking underground storage tanks).

SUBPART C: DETERMINING AREA BACKGROUND

Section 742.300 General

This Subpart provides procedures for determining area background concentrations for contaminants of concern. Except as described in Section 742.315(c) of this Subpart, area background concentrations may be used as remediation objectives for contaminants of concern at a site. The provisions of this Subpart shall not be used for determining area background for pH.

Section 742.305 Determination of Area Background for Soil

- a) Soil sampling results shall be obtained for purposes of determining area background levels in accordance with the following procedures:
 - 1) For volatile organic contaminants, sample results shall be based on discrete samples;
 - 2) For contaminants other than volatile organic contaminants, sample results shall be based on discrete samples or composite samples. If a person elects to use composite samples, each 0.5 acre of the area to be sampled shall be divided into quadrants and 5 random subsamples per quadrant shall be composited into 1 sample;
 - 3) Samples shall be collected from similar depths and soil types, which shall be consistent with the depths and soil types in which contaminant maximums are found in the areas of known or suspected releases; and
 - 4) Samples shall be collected from areas of the site or adjacent to the site that are unaffected by releases at the site.
- b) Area background shall be determined according to one of the following procedures:
 - 1) Prescriptive Approach:
 - A) A minimum of 10 soil sample results shall be used to determine if the sample set is normally distributed. These samples may be discrete or composite samples. The mean (\bar{x}) and standard deviation (s) of the sample set

shall be used to calculate the coefficient of variation (CV), from:

$$CV = s/x$$

If the CV is less than or equal to 1.0, the sample set shall be assumed to be normally distributed, and the prescriptive approach is allowed. If the CV is greater than 1.0, the sample set shall be assumed to not be normally distributed, and the prescriptive approach shall not be used.

- B) The Upper Tolerance Limit (UTL) of a normally distributed sample set may be calculated from:

$$UTL = x + (K \cdot s),$$

where K = the one-sided normal tolerance factor for estimating the 95 percent upper confidence limit of the 95th percentile of a normal distribution. Values for K shall be determined using Appendix A, Table B.

- C) The UTL shall be the upper limit of the area background concentration for the site.

2) Statewide Background Approach:

- A) The maximum value of the range of concentrations of inorganic chemicals in background soils listed in Appendix A, Table D may be used as the upper limit of the area background concentration for the site. In selecting the values to be used as area background, Appendix A, Table D shall be used for counties within and outside of Metropolitan Statistical Areas. Counties within and outside of Metropolitan Statistical Areas shall be as identified on Appendix A, Illustration A.
- B) Soil area background concentrations determined according to this statewide background approach shall be used as provided in Section 742.315(b)(1). If sampling results demonstrate concentrations above those in Appendix A and Table D, the person shall develop appropriate soil cleanup objectives in accordance with this Part, or may determine area background in accordance

with the procedures specified in Section 742.305.

- 3) Another statistically valid approach for determining area background concentrations approved by the Agency.

Section 742.310 Determination of Area Background for Groundwater

- a) Groundwater sampling results shall be obtained for purposes of determining area background in accordance with the following procedures:
 - 1) Samples shall be collected from areas of the site or adjacent to the site that are unaffected by releases at the site;
 - 2) The background monitoring wells, as determined in consultation with the Agency, shall be sufficient in number to account for the spatial and temporal variability, size, and number of known or suspected off-site releases of contaminants of concern, and the hydrogeological setting of the site;
 - 3) The samples shall be collected in consecutive quarters for a minimum of one year for each well or another sample schedule approved by the Agency;
 - 4) The samples shall be collected from the same stratigraphic unit(s) as the groundwater contamination at the site, using a well screen length equal to 10 feet unless the Agency approves a shorter or longer screen length; and
 - 5) The background monitoring wells shall be located hydraulically upgradient from the release(s) of contaminants of concern, unless the Agency approves that the upgradient location is undefinable or infeasible.
- b) Area background shall be determined according to one of the following procedures:
 - 1) Prescriptive Approach
 - A) The groundwater sampling results obtained in accordance with Section 742.310(a) shall be used to determine if the sample set is normally distributed. The mean (x) and standard deviation (s) of the sample set for

the background well(s) shall be used to calculate the coefficient of variation (CV), from:

$$CV = s/x$$

If the CV is less than or equal to 1.0, the sample set shall be assumed to be normally distributed, and the prescriptive approach is allowed. If the CV is greater than 1.0, the sample set shall be assumed to not be normally distributed, and the prescriptive approach shall not be used.

- B) If the sample set contains at least ten sample results, the Upper Tolerance Limit (UTL) of a normally distributed sample set may be calculated from:

$$UTL = x + (K \cdot s),$$

where K = the one-sided normal tolerance factor for estimating the 95 percent upper confidence limit of the 95th percentile of a normal distribution. Values for K shall be determined using Appendix A, Table B.

- C) If the sample set contains at least ten sample results, the UTL shall be the upper limit of the area background concentration for the site. If the sample set contains less than ten sample results, the maximum value of the sample set shall be the upper limit of the area background concentration for the site.

- 2) Another statistically valid approach for determining area background concentrations approved by the Agency.

Section 742.315 Use of Area Background Concentrations

- a) A person may request that area background concentrations determined pursuant to Sections 742.305 and 742.310 be used according to the provisions of Section 742.315(b). Such request shall address the following:
- 1) Suspected off-site sources of regulated substances of concern;
 - 2) The route or pathway of any suspected

- contamination reaching the site;
- 3) Physical and chemical properties of suspected contaminants reaching the site; and
 - 4) The location and justification of all background sampling points.
- b) Except as specified in Section 742.315(c), area background concentrations determined according to Sections 742.305(b)(1) or (b)(3) and 742.310 may be used as follows:
- 1) To support a request to eliminate a chemical as a contaminant of concern from further consideration for remediation at a site due to its presence as a result of background conditions; or
 - 2) As remediation objectives for regulated substances of concern at a site in lieu of remediation objectives developed pursuant to the other procedures of this Part.
- c) Area background concentrations shall not be used IN THE EVENT THAT THE AGENCY HAS DETERMINED IN WRITING THAT THE BACKGROUND LEVEL FOR A REGULATED SUBSTANCE POSES AN ACUTE THREAT TO HUMAN HEALTH OR THE ENVIRONMENT AT THE SITE WHEN CONSIDERING THE POST-REMEDIAL ACTION LAND USE. (Section 58.5(b)(3) of the Act)
- d) Engineered barriers and institutional controls may be necessary for cleanup objectives developed under this Subpart.

SUBPART D: TIER 1 EVALUATION

Section 742.400 Introduction

- a) A Tier 1 evaluation compares the concentration of contaminants of concern detected at a site to the baseline cleanup objectives provided in Appendix B, Tables A, B, C, D, and E. Use of Tier 1 cleanup objectives requires only limited site-specific information: concentrations of contaminants of concern, class of groundwater, land use classification, and, if appropriate, soil pH (see Appendix B, Illustration A).
- b) Although Tier 1 allows for differentiation between residential and industrial/commercial use of a site, institutional controls under Subpart I are required where cleanup objectives are based on an

industrial/commercial use. When developing soil cleanup objectives under Tier 1, three exposure routes (ingestion, inhalation, and migration to groundwater) shall be evaluated.

- c) Any given exposure route is not a concern if the concentrations of contaminants of concern detected at the site are all below the Tier 1 values of that given route. In such cases, no further evaluation of that route is necessary.

Section 742.405 Tier 1 Soil and Groundwater Cleanup Objectives

a) Soil

- 1) The Tier 1 groundwater and soil cleanup objectives are listed in Appendix B, Tables A and B. The pH-dependent Tier 1 soil cleanup objectives for identified ionizable organics or inorganics for the migration to groundwater exposure route (based on the total amount of contaminant present in the soil) are provided in Appendix B, Tables C and D.
- 2) The cleanup objectives listed in Appendix B, Table A are based upon residential property use. The cleanup objectives listed in Appendix B, Table B are based upon industrial/commercial use. Cleanup objective determinations relying on Appendix B, Table B require use of institutional controls in accordance with Subpart I.

- b) Tier 1 groundwater cleanup objectives are listed in Appendix B, Table E.

Section 742.410 Tables

- a) Soil cleanup objectives are listed in Appendix B, Tables A and B.

- 1) In Appendix B, Table A, the first column to the right of the chemical name lists soil cleanup objectives for residential properties based on direct ingestion of soil, while the second column lists the soil cleanup objectives for residential properties based on inhalation of vapors or soil particulates. The third and fourth columns in Appendix B, Table A list soil cleanup objectives for residential properties based on the migration to groundwater route for Class I and Class II groundwaters, respectively. The final column in Appendix B, Table A is the Acceptable Detection

Limit (ADL), where applicable.

- 2) In Appendix B, Table B, the first through fourth columns to the right of the chemical name list the soil cleanup objectives for industrial/commercial properties based on ingestion and inhalation of soil for two receptor populations: (1) industrial/commercial population; and (2) construction worker population. The fifth and sixth columns to the right of the chemical name in Appendix B, Table B list the soil cleanup objectives for industrial/commercial properties based on the migration to groundwater route for Class I and Class II groundwater, respectively. The final column in Appendix B, Table B is the ADL.
- b) Appendix B, Tables A and B list the groundwater cleanup objectives. The first column to the right of the chemical name presents cleanup objectives for Class I groundwater, and the second column presents the cleanup objectives for Class II groundwater.
- c) To use either Appendix B, Tables A or B, the Part 620 classification for groundwater at the site shall be determined. The levels of site groundwater contaminants are compared to the applicable groundwater cleanup objectives in Appendix B, Tables A and B. In using either Appendix B, Tables A or B groundwater is presumed to be Class I unless site-specific information demonstrates otherwise. Appendix D describes the procedures to demonstrate Class II groundwater.
- d) The most stringent soil cleanup objective of the three routes (ingestion, inhalation, and migration to groundwater) shall be compared to the concentrations of soil contaminants of concern measured at the site. Sample results may be averaged or soil samples may be composited in accordance with Section 742.230. If using Appendix B, Table B, the person shall use the most stringent soil cleanup objective from the ingestion and inhalation routes for both industrial/commercial populations and construction worker populations. Routes are not to be confused with populations.
- e) For those chemicals listed in Appendix B, Tables C and D, if a person elects to evaluate the migration to groundwater exposure route based on the total amount of contaminant in a soil sample (rather than TCLP analysis), the person shall determine the soil pH at the site and then select the appropriate soil cleanup

objectives from Appendix B, Tables C and D. If the soil pH is less than 4.5 or greater than 8.0, then Tables C and D are not applicable.

- f) If a cleanup objective for a chemical is less than the ADL, the ADL shall serve as the cleanup objective until the USEPA establishes a Practical Quantitation Limit (PQL) or Estimated Quantitation Limit (EQL) that is less than the cleanup objective.
- g) For contaminants of concern not listed in Appendix B, Tables A, B, and E, a person may request site-specific cleanup objectives from the Agency or propose site-specific cleanup objectives under Subpart H.

SUBPART E: TIER 2 GENERAL EVALUATION

Section 742.500 Introduction

- a) Tier 2 cleanup objectives are developed through the use of analytical models which allow site-specific data to be inputted (see Appendix C, Illustrations A and B). The acceptable analytical models identified in Appendix C, Tables A and C can be used to develop Tier 2 cleanup objectives.
- b) Tier 2 evaluation is only required for specific contaminants and corresponding exposure routes exceeding the Tier 1 cleanup objectives. When conducting Tier 2 evaluations, the values used in the calculations must have the appropriate units of measure. Appendix C, Tables B and D identify the appropriate units of measure.
- c) Any development of cleanup objectives using site-specific information outside the Tier 2 framework shall be evaluated under Tier 3.
- d) In conducting a Tier 2 evaluation, the following conditions shall be met:
 - 1) For each discrete sample, the total soil contamination of either a single contaminant or multiple contaminants shall not exceed the attenuation capacity of the soil as provided in Section 742.220.
 - 2) Institutional controls in accordance with Subpart I must be in place on the property when cleanup objectives are based on any of the following assumptions:

- A) Industrial/Commercial use;
 - B) Target cancer risk greater than 1 in 1,000,000 (not to exceed 1 in 10,000);
 - C) Engineered barrier(s); or
 - D) Or any combination of the above.
- 3) Cleanup objectives for noncarcinogenic compounds which affect the same target organ shall meet the requirements of Section 742.525.
 - 4) The soil cleanup objectives based on the inhalation and migration to groundwater exposure routes shall not exceed the soil saturation limit as provided in Section 742.220.
 - e) If Tier 2 groundwater cleanup values are calculated for groundwater contamination above Tier 1 groundwater objectives, then the requirements of Subpart G are applicable.

Section 742.505 Exposure Routes

- a) If the calculated Tier 2 value for an exposure route is more stringent than the corresponding Tier 1 cleanup objective, then the Tier 1 cleanup objective applies.
- b) If the calculated Tier 2 value for an exposure route is more stringent than the Tier 1 cleanup objective(s) for the other exposure routes, then the Tier 2 calculated value is the cleanup objective and Tier 2 cleanup objectives for the other exposure routes are not required.
- c) If the calculated Tier 2 value is less stringent than one or more of the remaining exposure routes, Tier 2 values are calculated for the remaining exposure route(s) with the most stringent Tier 2 calculated value becoming the Tier 2 cleanup objective.

Section 742.510 Land Use

- a) Present and future land use is evaluated in a Tier 2 evaluation. Acceptable exposure factors for the Tier 2 evaluation for residential, industrial/commercial, and construction worker uses are provided in the far right column of both Appendix C, Tables B and D. Use of exposure factors different from those in Appendix C,

Tables B and D must be approved by the Agency as part of a Tier 3 evaluation.

- b) If a Tier 2 evaluation is based on an industrial/commercial use, then:
 - 1) Construction worker exposures shall be evaluated; and
 - 2) Institutional controls are required in accordance with Subpart I.

Section 742.515 Target Cancer Risk Levels

- a) Unless institutional controls or engineered barriers are applied in accordance with Subparts I and J respectively, a target cancer risk not exceeding 1 in 1,000,000, or the applicable Class I or Class II groundwater cleanup objectives, must be used for all of the exposure routes.
- b) A target cancer risk of up to 1 in 10,000 may be established for Tier 2 soil cleanup objectives if the requirements of Subparts E and F are met.
- c) A target cancer risk of up to 1 in 10,000 may be established for Tier 2 groundwater cleanup objectives if the requirements of Subparts E and G are met.

Section 742.520 Chemicals with Cumulative Noncarcinogenic Effects

Appendix A, Table C lists the groups of chemicals from Appendix B, Tables A and B that have cleanup objectives based on noncarcinogenic toxicity and that affect the same target organ. If more than one chemical detected at a site affects the same target organ (i.e., has the same critical effect as defined by the RfD), the initially calculated cleanup value for each chemical in the group shall be corrected for cumulative effects as follows:

- a) Calculate the weighted average using the following equations:

$$\frac{x_1}{CUO_{x_1}} + \frac{x_2}{CUO_{x_2}} + \frac{x_3}{CUO_{x_3}} + \dots + \frac{x_n}{CUO_{x_n}}$$

where:

x_1 through x_n = Concentration of each individual contaminant at the location of concern. Note that, depending on the target organ/mode of action, the actual number of contaminants will range from 2 to 9.

$CUOx_n$ = A Tier 2 cleanup objective must be developed for each x_n .

If the value of the weighted average calculated in accordance with the equations above is less than or equal to 1.0, then no further remediation is necessary to meet the cleanup objectives for those chemicals.

If the value of the weighted average calculated in accordance with the equations above is greater than 1.0, then additional remediation is required to meet the cleanup objectives for those chemicals; or

- b) Divide each individual chemical's cleanup objective by the number of chemicals in that specific target organ group that were detected at the site. Each of the contaminant concentrations at the site is then compared to the cleanup objectives that have been adjusted to account for this potential additivity. For the noncarcinogenic contaminants listed in Appendix A, Table C, a respective soil cleanup objective need be no lower than the respective value listed in Appendix B, Tables A or B.

Section 742.525 Chemical and Site Properties

a) Physical and Chemical Properties of Contaminants

Tier 2 evaluations require information on the physical and chemical properties of the contaminants of concern. The physical and chemical properties used in a Tier 2 evaluation are contained in Appendix C, Table E. If the site has contaminants not included in this table, a person may request the Agency to provide the applicable physical and chemical input values or may propose input values under Subpart H. If a person proposes to apply values other than those in Appendix C, Table E, the evaluation shall be considered under Tier 3.

b) Soil and Groundwater Parameters

- 1) A Tier 2 evaluation requires examination of soil and groundwater parameters. The parameters that may be varied, and the conditions under which these parameters are determined as part of Tier 2, are summarized in Appendix C, Tables B and D. If a person proposes to vary site-specific parameters outside of the framework of these tables, the evaluation shall be considered under Tier 3.
- 2) To determine site-specific physical soil parameters, a minimum of one boring per 0.5 acre of contamination shall be collected. This boring must be deep enough to allow the collection of the required field measurements. The site-specific physical soil parameters must be determined from the portion of the boring representing the stratigraphic layer(s) being evaluated. For example, if evaluating the migration of a contaminant from the soil to the groundwater, two samples from the boring will be required:
 - A) A sample of the predominant soil type for the vadose zone; and
 - B) A sample of the predominant soil type for the saturated zone.
- 3) A site-specific SSL dilution factor (used in developing soil cleanup objectives based upon the protection of groundwater) may be determined by substituting site information in Equation S13 in Appendix C, Table A. To make this demonstration, a minimum of three (3) monitoring wells shall be used to determine the hydraulic gradient. As an alternative, the default dilution factor value of 10 listed in Appendix C, Table B is used. If monitoring wells are used to determine the hydraulic gradient, the soil cores taken from the borings shall be visually inspected to ensure there are no significant differences in the stratigraphy. If the soil cores have similar soil types, one boring shall be used to determine the site-specific physical soil parameters. If there are significant differences, all of the borings shall be evaluated before determining the site-specific physical soil parameters for the site.
- 4) Not all of the parameters identified in Appendix

C, Tables B and D need to be determined on a site-specific basis. A person may choose to collect partial site-specific information and use default values listed in Appendix C, Tables B and D, respectively for the rest of the parameters.

c) Groundwater Investigation

In using Tier 2, groundwater is presumed to be Class I unless site-specific information demonstrates otherwise. Appendix D describes the procedures to demonstrate Class II groundwater.

SUBPART F: TIER 2 SOIL EVALUATION

Section 742.600 Overview

- a) Appendix C, Table A lists equations that shall be used under a Tier 2 evaluation to calculate soil cleanup objectives prescribed by SSL (see also Appendix C, Illustration A). This set of equations is divided into three categories based on the exposure routes:
 - 1) Ingestion;
 - 2) Inhalation; and
 - 3) Migration to groundwater.
- b) Appendix C, Table C lists equations that are used under a Tier 2 evaluation to calculate soil cleanup objectives prescribed by RBCA. These equations are divided into three categories for the exposure routes set forth in subsections (b)(1) through (b)(3) of this Section. The first two categories of equations must be evaluated whenever an ingestion or inhalation Tier 2 cleanup objective is calculated. The most stringent value must be selected as the Tier 2 soil cleanup objective for exposure routes listed in subsections (b)(1) through (b)(3) of this Section. Following are the three categories of exposure routes under RBCA:
 - 1) The combined routes of: ingestion of soil, inhalation of vapors and particulates, and dermal contact;
 - 2) The ambient vapor inhalation route from subsurface soils; and
 - 3) The migration to groundwater route.

- c) The equations in either Appendix C, Tables A or C may be used to calculate cleanup objectives for each contaminant under Tier 2, if the following requirements are met:
- 1) The Tier 2 soil cleanup objectives for the ingestion and inhalation exposure routes shall use the applicable equations from the same approach (i.e., SSL equations in Appendix C, Table A or RBCA equations in Appendix C, Table C).
 - 2) The equations used to calculate soil cleanup objectives for the migration to groundwater exposure route are not dependent on the approach utilized to calculate soil cleanup objectives for the other exposure routes. For example, it is acceptable to use the SSL equations for calculating Tier 2 soil cleanup objectives for the ingestion and inhalation exposure routes, and the RBCA equations for calculating Tier 2 soil cleanup objectives for the migration to groundwater exposure route.
 - 3) Combining equations from Appendix C, Tables A and C to form a new analytical model is not allowed. In addition, Appendix C, Tables A and C must use their own applicable parameters identified in Appendix C, Tables B and D, respectively.
- d) In calculating soil cleanup objectives for industrial/commercial land uses, applicable calculations shall be performed twice: once using industrial/commercial exposure default values and once using construction worker exposure default values. The more stringent soil cleanup objectives derived from these calculations must be used for further Tier 2 evaluations.
- e) Tier 2 datasheets provided by the Agency shall be used to present calculated Tier 2 cleanup objectives, if required by the particular Agency program.

Section 742.605 Parameters for Soil Cleanup Objective
Equations

- a) Appendix C, Tables B and D list the input parameters for the SSL and RBCA equations, respectively. The first column lists each parameter as it is presented in the equation. The next column defines the parameters. The third column shows the units for the parameters. The

fourth column identifies where information on the parameters can be obtained (i.e., field measurement, applicable equation(s), reference source, or default value). The last column identifies how the parameters can be generated. A discussion of each parameter group follows.

b) Default values

Default Values are numerical quantities or inputs specified for use in the Tier 2 equations. The default values used in the SSL and RBCA equations are listed in Appendix C, Tables B and D respectively.

c) Site-specific information

Site-specific information is a parameter measured, obtained, or determined from the site to calculate Tier 2 cleanup objectives. The fourth column of Appendix C, Tables B and D identifies those site-specific parameters that may require direct field measurement. For some parameters, numerical default inputs have been provided in the last column of Appendix C, Tables B and D to substitute for site-specific information. In some cases, information on the receptor or soil type is required to select the applicable numerical default inputs. Site-specific information includes:

- 1) Physical soil parameters identified in Appendix C, Table F. The second column identifies the location where the sample is to be collected. Acceptable methods for measuring or calculating these soil parameters are identified in the last column of Appendix C, Table F.
- 2) Engineering or institutional controls which can affect the target cancer risk. Subparts I and J describe applicable engineering and institutional controls under a Tier 2 evaluation.
- 3) Receptor classification (i.e., residential, industrial/commercial, and construction worker scenarios).

d) Toxicological-specific information

Toxicological-specific information is used to calculate Tier 2 cleanup objectives for the following parameters:

Oral Reference Dose (RfD_o, expressed in mg/kg-d)

Oral Slope Factor (SF_o , expressed in $(\text{mg/kg-d})^{-1}$)

Inhalation Unit Risk Factor (URF expressed in $(\text{ug/m}^3)^{-1}$)

Inhalation Reference Concentration (RfC , expressed in mg/m^3)

Inhalation Reference Dose (RfD_i , expressed in mg/kg-d)

Inhalation Slope Factor (SF_i , expressed in $(\text{mg/kg-d})^{-1}$)

e) Chemical-specific information

Chemical-specific information used to calculate Tier 2 cleanup objectives is listed in Appendix C, Table E.

f) Calculations

Calculating numerical quantities for some parameters requires the use of equations listed in Appendix C, Tables A or C. The parameters that are calculated are listed in Appendix C, Tables B and D.

Section 742.610 SSL Soil Equations

a) This Section sets forth the equations and parameters used to develop Tier 2 soil cleanup objectives for the three exposure routes using the SSL approach.

b) Ingestion

- 1) Equations S1 through S3 form the basis for calculating Tier 2 cleanup objectives for the ingestion route using the SSL approach. Equation S1 is used to calculate soil cleanup objectives for non-carcinogenic contaminants. Equations S2 and S3 are used to calculate soil cleanup objectives for carcinogenic contaminants for residential and industrial/commercial uses, respectively.
- 2) For Equation S1, the SSL default values for parameters under residential and industrial/commercial uses cannot be modified with site-specific information.
- 3) For Equations S2 and S3, the only parameter that can be modified is the target cancer risk. A target cancer risk of 1 in 10,000 is acceptable if the applicable exposure routes have been managed

through the use of approved engineered barriers and institutional controls. The remaining parameters in Equations S2 and S3 are default values, and the corresponding numerical inputs in Appendix C, Table B must be used to calculate the Tier 2 SSL ingestion route cleanup objectives.

c) Inhalation

- 1) Equations S4 through S10 are used to calculate Tier 2 cleanup objectives for the inhalation route using the SSL approach. Equation S4 is used to calculate residential use and industrial/commercial use soil cleanup objectives for noncarcinogenic contaminants. Equation S5 is used to calculate construction worker soil cleanup objectives for non-carcinogenic contaminants. Equation S6 is used to calculate residential use and industrial/commercial use soil cleanup objectives for carcinogenic contaminants. Equation S7 is used to calculate construction worker soil cleanup objectives for carcinogenic contaminants.
- 2) In Equation S4, numerical quantities can be calculated for the Volatilization Factor (VF) and Particulate Emission Factor (PEF), using Equation S8. This equation relies on various input parameters from a variety of sources.
- 3) The remaining parameters in Equation S4 have either SSL default values listed in Appendix C, Table B or toxicological-specific information (i.e., RfC) which can be requested from the Agency.
- 4) For Equation S5, a numerical value for VF' can be calculated using Equation S9. The remaining parameters in Equation S5 have either SSL default values listed in Appendix C, Table B or toxicological-specific information (i.e., RfC) which can be requested from the Agency.
- 5) For Equation S6, the parameters VF can be calculated. The remaining parameters in Equation S6 have either default values listed in Appendix C, Table B, or toxicological-specific information (i.e., URF) which can be requested from the Agency.

- 6) For Equation S7, the numerical value for VF' can be calculated using Equation S9. The remaining parameters in Equation S7 have either default values listed in Appendix C, Table B, or toxicological-specific information (i.e., URF) which can be requested from the Agency.

d) Migration to Groundwater

- 1) Equation S11 forms the basis for calculating Tier 2 soil cleanup objectives for the migration to groundwater route using the SSL approach. The numerical quantities for four parameters, the Target Soil Leachate Concentration (C_L), Soil-Water Partition Coefficient (K_d), Air-Filled Soil Porosity (θ_a), and Water-Filled Soil Porosity (θ_w) are calculated using Equations S15, S18, S19 and S20, respectively.
- 2) The remaining parameter in Equation S11 is H' , which is listed in Appendix C, Table E.
- 3) The default value for GW_{obj} is the Tier 1 groundwater objective. As an alternative to using the Tier 1 groundwater cleanup objectives, a target risk of up to 1 in 10,000 may be used to calculate GW_{obj} using Equation S22, based on residential intake rates if approved engineered barriers and institutional controls are in place in accordance with Subpart J and I, respectively.

Section 742.615 RBCA Soil Equations

- a) This Section presents the equations and describes the parameters used to develop Tier 2 soil cleanup objectives for the three exposure routes using the RBCA approach. The equations in subsections (b) and (c) of this Section shall be used to generate Tier 2 soil cleanup objectives for the combined ingestion and inhalation exposure route.
- b) Ingestion, Inhalation and Dermal Contact
 - 1) Equations R1 and R2 form the basis for deriving Tier 2 cleanup objectives for the ingestion of soil, inhalation of vapors and dermal-contact routes using the RBCA approach. Equation R1 is used to calculate soil cleanup objectives for carcinogenic contaminants. Equation R2 is used to calculate soil cleanup objectives for non-

carcinogenic contaminants. Soil cleanup objectives for the inhalation of vapors from the subsurface soils must also be calculated in accordance with the procedures outlined in subsection (c) of this Section and compared to the values generated from Equations R1 or R2. The smaller value from these calculations is the Tier 2 soil cleanup objective for the combined ingestion, inhalation, and dermal contact exposure route.

- 2) In Equation R1, numerical quantities are calculated for two parameters [the volatilization factor for surficial soils (VF_{ss}) and volatilization factor for subsurface soils regarding particulates (V_p)] using Equations R3, R4, and R5 respectively.
- 3) VF_{ss} uses Equations R3 and R4 to derive a numerical value. Both equations must be used to calculate the VF_{ss} . The lowest calculated value from these equations must be substituted into the Equation R1.
- 4) The remaining parameters in Equation R1 have either default values listed in Appendix C, Table D or toxicological-specific information (i.e., SF_o , SF_i) which can be requested from the Agency.
- 5) For Equation R2, the parameters VF_{ss} and VP_p are calculated. The remaining parameters in Equation R2 have either default values listed in Appendix C, Table D or toxicological-specific information (i.e., RfD_o , RfD_i) which can be requested from the Agency.
- 6) For pesticides, a dermal absorption factor of 0.5 shall be used. For metals, dermal absorption may be disregarded.

c) Inhalation of Vapors for Soils Below One Meter

- 1) Equations R7 and R8 form the basis for deriving Tier 2 cleanup objectives for the ambient vapor inhalation route using the RBCA approach. Equation R7 is used to calculate soil cleanup objectives for carcinogenic contaminants. Equation R8 is used to calculate soil cleanup objectives for noncarcinogenic contaminants.
- 2) For Equation R7, the carcinogenic risk-based

screening level for air ($RBSL_{air}$) and the volatilization factor for soils below one meter to ambient air (VF_{samb}) have numerical values that are calculated using equations R9 and R11, respectively. Both equations rely on input parameters from a variety of sources.

- 3) The noncarcinogenic risk-based screening level for air ($RBSL_{air}$) and the volatilization factor for soils below one meter to ambient air (VF_{samb}) in Equation R8 have numerical quantities that can be calculated using equations R10 and R11, respectively.

d) Migration to Groundwater

Equation R12 forms the basis for deriving Tier 2 cleanup objectives for the leaching to groundwater route using the RBCA approach. The parameters, groundwater at the source (GW_{source}) and Leaching Factor (LF_{gw}), have numerical values that are calculated using equations R13 and R14, respectively.

SUBPART G: TIER 2 GROUNDWATER EVALUATION

Section 742.700 General

If the contaminant concentrations in the groundwater exceed the applicable Tier 1 cleanup objectives, a person has the following options (see Appendix C, Illustration B):

- a) Remediate to Tier 1 cleanup objectives;
- b) Demonstrate that the groundwater contamination is at or below area background levels in accordance with Subpart C and, if necessary, an institutional control restricting usage of the groundwater is in place in accordance with Subpart I;
- c) Obtain approval from the Board to:
 - 1) Reclassify the groundwater pursuant to 35 Ill. Adm. Code 620.260; or
 - 2) Use an adjusted standard pursuant to Section 28.1 of the Act;
- d) Conduct a Tier 3 evaluation in accordance with Subpart H; or

- e) Develop Tier 2 groundwater cleanup objectives in accordance with Section 742.705 and remediate to that level, if necessary.

Section 742.705 Tier 2 Groundwater Cleanup Objectives

To develop a groundwater cleanup objective that exceeds the applicable Tier 1 concentration, a person may request approval from the Agency if the person has performed the following:

- a) Calculated a maximum acceptable Tier 2 groundwater cleanup objective in accordance with Section 742.710;
- b) Identified the horizontal and vertical extent of groundwater for which the Tier 2 groundwater cleanup objective is sought;
- c) Taken corrective action to remove any free product and control the source of contamination to the groundwater;
- d) Using Equation R26 in accordance with Section 742.715, demonstrated that no existing potable water supply well will be adversely impacted by the remaining groundwater contamination above the applicable Tier 1 groundwater standard;
- e) Using Equation R26 in accordance with Section 742.715, demonstrated that the quality of the groundwater discharging into the surface water meets the applicable surface water quality standards under 35 Ill. Adm. Code 302;
- f) Demonstrated the location of the release is not within the minimum or maximum setback zone of a potable water supply well nor within a regulated recharge area of a potable water supply well;
- g) If the selected corrective action includes an engineered barrier to minimize migration of contamination from the soil to the groundwater, demonstrated that the barrier will remain in place in the future and that an institutional control is in place in accordance with Subpart I; and
- h) Demonstrated that anticipated beneficial uses (appropriate for the class of groundwater of concern) are not adversely impacted. As an example, a demonstration would satisfy this requirement if it showed that for all areas of potential impact, institutional controls restricting groundwater usage

are in place in accordance with Subpart I.

Section 742.710 Calculation of Tier 2 Groundwater Cleanup Objectives

a) The procedures to calculate maximum acceptable Tier 2 groundwater cleanup objectives as part of a Tier 2 evaluation are as follows:

1) For carcinogens:

- A) A target cancer risk not exceeding 1 in 10,000 can be used to develop Tier 2 groundwater cleanup objectives provided an institutional control is in place in accordance with Subpart I to limit the on-site usage of the groundwater. However, unless the requirements of subsection (a) (1) (B) of this Section are met, the Tier 2 groundwater objective at the property boundary must be no less stringent than its Tier 1 groundwater cleanup objective.
- B) Off-site Tier 2 groundwater cleanup objectives shall not exceed the Tier 1 objective unless the off-site property(ies) has institutional controls in place in accordance with Subpart I.
- C) Equation R25 in Appendix C, Table C can be used to calculate groundwater cleanup objectives for carcinogens.

2) For noncarcinogens:

- A) Unless the requirements of subsection (a) (2) (B) of this Section are met, the Tier 2 groundwater objective at the property boundary must be no less stringent than the applicable Tier 1 groundwater cleanup objective.
- B) Off-site Tier 2 groundwater cleanup objectives shall not exceed the applicable Tier 1 objectives, unless the off-site property(ies) has institutional controls in place in accordance with Subpart I.
- C) The provisions of 35 Ill. Adm. Code 620, Subpart F are used to calculate Tier 2

groundwater cleanup objectives for noncarcinogens.

- b) A Tier 2 groundwater cleanup objective that exceeds the water solubility of that chemical (refer to Appendix C, Table E for solubility values) is not allowed.

Section 742.715 Calculations to Predict Impacts from
Remaining Groundwater Contamination

- a) Equation R26 models the contaminant concentration along the centerline of a plume emanating from a vertical planar source in the aquifer (dimensions S_v wide and S_d deep). This model accounts for both three-dimensional dispersion (X is the direction of groundwater flow, y is the other horizontal direction and z is the vertical direction) and biodegradation.

1) The parameters in this equation are:

- A) X = distance from the planar source to the location of concern, along the centerline of the plume (i.e., $y=0$, $z=0$)
- B) $C_{(x)}$ = the concentration of the contaminant at a distance x from the source, along the centerline of the plume
- C) $C_{(source)}$ = the greatest concentration of the contaminant in the groundwater at the source of the contamination. As indicated above, the model assumes a planar source discharging groundwater at a concentration equal to $C_{(source)}$.
- D) α_x = dispersivity in the x direction (i.e., $0.10 \cdot X$)
- E) $\alpha_y = \frac{\alpha_x}{3}$ dispersivity in the y direction (i.e., $\frac{\alpha_x}{3}$)
- F) $\alpha_z = \frac{\alpha_x}{20}$ dispersivity in the z direction (i.e., $\frac{\alpha_x}{20}$)

- G) U = specific discharge (i.e., actual groundwater flow velocity through a porous medium; takes into account the fact that the groundwater actually flows only through the pores of the subsurface materials) [i.e., $(k \cdot I)/\theta_T$].
 - H) λ = first order degradation constant obtained from Appendix C, Table E
 - I) S_y = width of planar source in the y direction
 - J) S_d = depth of planar source in the z direction
- 2) The following parameters are determined through field measurements: U , k , I , θ_T , S_y , S_d .
 - A) The determination of values for U , k , I , and θ_T can be obtained through the appropriate laboratory and field techniques.
 - B) From the immediate down-gradient edge of the source of the groundwater contamination values for S_y and S_d shall be determined. S_y is defined as the width of groundwater at the source which exceeds the Tier 1 groundwater cleanup objective. S_d is defined as the depth of groundwater at the source which exceeds the Tier 1 groundwater cleanup objective.
 - 3) The value of $C_{(source)}$ equals the greatest concentration of the contaminant in the groundwater at the source of the contamination.
- b) Once values are obtained for all the input parameters identified in subsection (a) of this Section, the contaminant concentration along the centerline of the plume a distance X from the source shall be calculated.
- 1) To demonstrate that no water supply well is adversely impacted, X shall be the distance from the down-gradient edge of the source of the contamination at the site to the nearest water supply well. This calculation must show that the contaminant in the groundwater at this location ($C_{(x)}$), does not exceed the applicable Tier 1 groundwater cleanup objective.

- 2) To demonstrate that no surface water is adversely impacted, X shall be the distance from the down-gradient edge of the source of the contamination at the site to the nearest surface water body. This calculation must show that the contaminant in the groundwater at this location ($C_{(x)}$), does not exceed the applicable surface water quality standard.

SUBPART H: TIER 3 EVALUATION

Section 742.800 Introduction

- a) Tier 3 sets forth a flexible framework to develop cleanup objectives outside of the requirements of Tiers 1 and 2. Although Tier 1 evaluations and Tier 2 evaluations are not prerequisites to conduct Tier 3 evaluations, data from Tier 1 and Tier 2 can assist in developing cleanup objectives under a Tier 3 evaluation.
- b) The level of detail required to adequately characterize a site depends on the particular use of Tier 3. Tier 3 generally requires additional investigative efforts beyond those described in Tier 2 to characterize the physical setting of the site. However, in situations where remedial efforts have simply reached a physical obstruction (e.g., a building), additional investigation may not be necessary for a Tier 3 submittal.
- c) Scenarios that can be considered for a Tier 3 evaluation include, but are not limited to:
 - 1) Modification of parameters not allowed under Tier 2 (e.g., a target hazard quotient greater than 1 is requested because a site has an asphalt cap);
 - 2) Use of analytical models different from those used in Tier 2;
 - 3) Analysis of site-specific risks using formal risk assessment, probabilistic data analysis, and sophisticated fate and transport models;
 - 4) Requests for site-specific cleanup objectives because a "common sense" assessment indicates further remediation is not practical (e.g., the remaining contamination is under a structure such as a permanent building);

- 5) Incomplete exposure route(s), (e.g., due to site-specific conditions, contaminants are deeper than any likely excavation activity and unlikely to pose an inhalation or ingestion risk);
 - 6) Use of toxicological-specific information not available from the sources listed in Tier 2; and
 - 7) Land uses which are substantially different from the assumed residential or industrial/commercial uses of a site which underlie Tiers 1 and 2 (e.g., a site will be used for recreation in the future and cannot be evaluated in Tiers 1 or 2).
- d) Requests for approval of a Tier 3 evaluation must be submitted to the Agency for review under the program under which remediation is performed. When reviewing a submittal under Tier 3, the Agency shall consider WHETHER THE INTERPRETATIONS AND CONCLUSIONS REACHED ARE SUPPORTED BY THE INFORMATION GATHERED. (Section 58.7(e) (1) of the Act) The Agency shall approve a Tier 3 evaluation if the applicant submits the information required under this Part and establishes through such information that public health is protected and that any threat to human health and the environment has been minimized.

Section 742.805 Modifications of Parameters

Any proposed changes to Tier 2 parameters which are not provided for in Tier 2 shall be submitted to the Agency for review and approval. A submittal under this Section shall include the following information:

- a) The justification for the modification; and
- b) The technical and mathematical basis for the modification.

Section 742.810 Alternative Models

Any proposals for the use of analytical models other than those specified in Tier 2 shall be submitted to the Agency for review and approval. A submittal under this Section shall include the following information:

- a) Physical and chemical properties of contaminants;
- b) Contaminant movement properties;
- c) Contaminant availability to receptors;

- d) Receptor exposure to the contaminants;
- e) Mathematical and technical justification for the model proposed;
- f) A licensed copy of the model shall be provided to the Agency; and
- g) Demonstration that the models were correctly applied.

Section 742.815 Formal Risk Assessments

A full-scale site-specific risk assessment shall demonstrate that contaminants at a site do not pose a significant risk to any human receptor. All site-specific risk assessments shall be submitted to the Agency for review and approval. A submittal under this Section shall address the following factors:

- a) Whether the risk assessment procedure used is nationally recognized and accepted including, but not limited to, those procedures incorporated by reference in Section 742.210;
- b) Whether the site specific data reflect actual site conditions;
- c) The adequacy of the investigation of present and future potential exposure routes and risks to receptors identified at the site;
- d) The appropriateness of the sampling and analysis;
- e) The adequacy and appropriateness of toxicity information;
- f) The extent of contamination; and
- g) Whether the calculations were accurately performed.

Section 742.820 Impractical Remediation

Any request for site-specific cleanup objectives due to impracticality of remediation shall be submitted to the Agency for review and approval. A submittal under this Section shall include the following information:

- a) The reason(s) why the remediation is impractical;
- b) The extent of contamination;
- c) Geology, including soil types;

- d) The potential impact to groundwater;
- e) Results and locations of sampling events;
- f) Map of the area, including all utilities and structures; and
- g) Present and future uses of the area of contamination.

Section 742.825 Exposure Routes

Technical information may demonstrate that there is no actual or potential impact of contaminants of concern to receptors from a particular exposure route. In these instances, a request to evaluate whether that exposure route is of concern shall be submitted to the Agency for review and approval. A submittal under this Section shall include the following information:

- a) Description of the route to be evaluated;
- b) Technical support including a discussion of the natural or man-made barriers to exposure through that route, calculations, and modelling results;
- c) Physical and chemical properties of contaminants;
- d) Contaminant migration properties;
- e) Description of the site and physical site characteristics; and
- f) Discussion of the result and possibility of the route becoming active in the future.

Section 742.830 Derivation of Toxicological Data

If toxicological-specific information is not available for one or more contaminants of concern from the sources incorporated by reference in Section 742.210, the derivations of toxicological-specific information shall be submitted for Agency review and approval. A submittal under this Section shall address the following factors:

- a) Whether nationally recognized and accepted procedures were used including those incorporated by reference in Section 724.210 and those set forth in 35 Ill. Adm. Code 620 Subpart F; and
- b) Whether the calculations were accurately performed.

Section 742.835 Agricultural Uses and Ecological Receptors (Reserved)

SUBPART I: INSTITUTIONAL CONTROLS

Section 742.900 General

- a) Any person who develops cleanup objectives under this Part based on an industrial/commercial use or based on engineered barriers under Subpart J shall meet the requirements of this Subpart relative to institutional controls.
- b) The Agency shall not approve any cleanup objective under this Part that is based on the use of institutional controls unless the person has proposed institutional controls meeting the requirements of this Subpart. A proposal for approval of institutional controls shall provide the following:
 - 1) Identification of the type or types of institutional controls from among the types recognized in this Subpart; and
 - 2) A demonstration that the requirements under this Subpart for the selected institutional control have been met.
- c) The following types of institutional controls are recognized under this Subpart:
 - 1) No Further Remediation Letters under 35 Ill. Adm. Code 740;
 - 2) Restrictive covenants and deed restrictions;
 - 3) Negative easements;
 - 4) Ordinances adopted and administered by a unit of local government; and
 - 5) Agreements between a property owner and a highway authority with respect to any contamination remaining under highways.

BOARD NOTE: Definitions in the Illinois Highway Code for "highway authority", "highway", and "right-of-way" are applicable to this Part.

Section 742.905 No Further Remediation Letters

- a) A No Further Remediation Letter may be used as an institutional control under this Part if the requirements of this Section are met and the Agency has determined pursuant to 35 Ill. Adm. Code 740 that "no

further remediation" is required as to the property(ies) to which the letter is to apply.

- b) A request for approval of a No Further Remediation Letter as an institutional control shall provide the following:
 - 1) A scaled map delineating the horizontal extent of contamination above the applicable Tier 1 cleanup objectives;
 - 2) Information showing the concentration of contaminants in which the applicable Tier 1 cleanup objectives are exceeded;
 - 3) A scaled map delineating the legal boundaries of all properties subject to the No Further Remediation Letter under which contamination is located that exceeds the applicable Tier 1 cleanup objectives;
 - 4) Information identifying the current owner(s) of each property identified in subsection (b) (3) of this Section; and
 - 5) Authorization by the current owner(s) of each property identified in subsection (b) (3) of this Section to record the No Further Remediation Letter.
- c) THE recipient of the letter SHALL SUBMIT THE LETTER TO THE OFFICE OF THE RECORDER OR THE REGISTRAR OF TITLES OF THE COUNTY IN WHICH THE SITE IS LOCATED WITHIN 45 DAYS OF RECEIPT OF THE LETTER. THE OFFICE OF THE RECORDER OR THE REGISTRAR OF TITLES SHALL ACCEPT AND RECORD THAT LETTER IN ACCORDANCE WITH ILLINOIS LAW SO THAT IT FORMS A PERMANENT PART OF THE CHAIN OF TITLE FOR THE SITE. Proper recording of the No Further Remediation letter shall consist of adding the letter and an Environmental Cover Letter to other public documents that would normally be examined during a title search. (Section 58.8(a) of the Act)
- d) A NO FURTHER REMEDIATION LETTER SHALL NOT BECOME EFFECTIVE UNTIL OFFICIALLY RECORDED IN ACCORDANCE with subsection (c) of this Section. THE recipient of the Letter SHALL OBTAIN AND SUBMIT TO THE AGENCY A CERTIFIED COPY OF THE LETTER AS RECORDED. (Section 58.8(b) of the Act)
- e) AT NO TIME SHALL ANY SITE FOR WHICH LAND USE HAS BEEN restricted under a No Further Remediation Letter BE

USED IN A MANNER INCONSISTENT WITH such LAND USE LIMITATION UNLESS FURTHER INVESTIGATION OR REMEDIAL ACTION HAS BEEN CONDUCTED THAT DOCUMENTS THE ATTAINMENT OF OBJECTIVES APPROPRIATE FOR THE NEW LAND USE AND A NEW LETTER is OBTAINED AND RECORDED IN ACCORDANCE WITH subsection (c) of this Section. (Section 58.8(c) of the Act)

- f) Violation of the terms of a No Further Remediation Letter shall be grounds for voidance of the Letter and the Agency's "No Further Remediation" determination.

Section 742.910 Restrictive Covenants, Deed Restrictions, and Negative Easements

- a) A restrictive covenant, deed restriction, or negative easement may be used as an institutional control under this Part if the requirements of this Section are met and the Agency has determined pursuant to a program not covered by 35 Ill. Adm. Code 740 that "no further remediation" is required as to the property(ies) to which the institutional control is to apply.
- b) A request for approval of a restrictive covenant, deed restriction or negative easement as an acceptable institutional control, shall provide the following:
 - 1) A copy of the restrictive covenant, deed restriction, or negative easement in the form it will be recorded with the Office of the Recorder or Registrar of Titles in the county where the site is located. The restrictive covenant, deed restriction, or negative easement shall reference or incorporate the terms of the "No Further Remediation" determination so as to require any current owners and all successors in interest to meet the requirements of the "No Further Remediation" determination as a condition of use of the property;
 - 2) A scaled map showing the horizontal extent of contamination above the applicable Tier 1 cleanup objectives;
 - 3) Information showing the concentration of contaminants in which the applicable Tier 1 cleanup objectives are exceeded;
 - 4) A scaled map showing the legal boundaries of all properties subject to the restrictive covenant, deed restriction, or negative easement under which contamination is located that exceeds the

applicable Tier 1 cleanup objectives;

- 5) Information identifying the current owner(s) of each property identified in subsection (b)(4) of this Section; and
 - 6) Authorization by the current owner(s) of each property identified in subsection (b)(5) of this Section to record the restrictive covenant or deed restriction.
- c) Any restrictive covenant, deed restriction, or negative easement approved by the Agency pursuant to this Part shall be recorded with the "No Further Remediation" determination in the Office of the Recorder or the Registrar of Titles of the county in which the site is located within 45 days of receipt of the Agency approval in accordance with Section 742.905(c).
 - d) An institutional control approved under this Section shall not become effective until officially recorded in accordance with subsection (c) of this Section. The person receiving the approval shall obtain and submit to the Agency a certified copy of the institutional control as recorded.
 - e) At no time shall any site for which land use has been restricted under an institutional control approved under this Section be used in a manner inconsistent with such land use limitation unless further investigation or remedial action has been conducted that documents the attainment of objectives appropriate for such land use and a new institutional control is approved and recorded in accordance with subsection (c) of this Section.
 - f) Violation of the terms of an institutional control approved under this Section shall be grounds for voidance of the institutional control and the Agency's "No Further Remediation" determination.

Section 742.915 Ordinances

- a) An ordinance adopted by a unit of local government that effectively prohibits the use of groundwater as a potable supply of water may be used as an institutional control to meet Section 742.705 if the requirements of this Section are met and the Agency has determined that no further remediation is required as to the property(ies) to which the institutional control is to apply.

- b) A request for approval of a local ordinance as an institutional control shall provide the following:
- 1) A copy of the ordinance restricting groundwater use certified by the local unit of government in which the site is located. The ordinance must demonstrate that potable use of groundwater from water supply wells is prohibited;
 - 2) A scaled map(s) delineating the horizontal and vertical extent of groundwater contamination above the applicable Tier 1 cleanup objectives;
 - 3) Information showing the concentration of contaminants in which the applicable Tier 1 cleanup objectives are exceeded;
 - 4) A scaled map delineating the legal boundaries of all properties under which groundwater is located which exceeds the applicable Tier 1 groundwater cleanup objectives;
 - 5) Information identifying the current owner(s) of each property identified in subsection (b)(4) of this Section; and
 - 6) Proof that the information required in subsections (b)(1) through (b)(5) of this Section and the notification required in subsection (c) of this Section has been submitted to the current owner(s) identified in subsection (b)(5) of this Section.
- c) Each of the owners of the property identified in subsection (b)(5) of this Section must receive written notification that Tier 2 groundwater cleanup objectives under Section 742.705 is being requested from the Agency for the groundwater beneath their respective properties. Written proof of this notification shall be submitted to the Agency prior to the approval of the Tier 2 groundwater cleanup objective. The notification shall include:
- 1) The name and address of the local unit of government;
 - 2) The citation to the ordinance;
 - 3) The legal description of the property being sent notice;
 - 4) A statement that the ordinance restricting groundwater use is being used by the Agency in

reviewing a request for a Tier 2 groundwater cleanup objective;

- 5) A statement that the Tier 2 groundwater cleanup objective is the result of a release at the site, with the site name, address, and Agency site number; and
 - 6) A statement as to where more information may be obtained regarding the ordinance.
- d) The current owner or successors in interest of a site who have received approval of use of an ordinance as an institutional control under this Section shall monitor activities of the unit of local government relative to variance requests or changes in the ordinance relative to the use of potable groundwater and shall:
- 1) Notify the Agency and any owner of a site identified in subsection (b) (5) of this Section of any variance requests or ordinance changes at least thirty (30) days prior to the date the local government is scheduled to take action on the request or change; and
 - 2) Notify the unit of local government at least fourteen (14) days prior to the scheduled action date that the site has been issued an alternative groundwater standard.
- e) The information required in subsections (a) (1) through (a) (6) of this Section and the Agency letter approving the Tier 2 groundwater cleanup objective shall be submitted to the local unit of government. Proof that the information has been filed with the local unit of government shall be provided to the Agency.
- f) A site owner who has received approval of use of an ordinance as an institutional control under this Section shall record as an institutional control under Section 742.905 or Section 742.910, as applicable, the site owner's duties under subsection (c) of this Section to monitor activities of the unit of local government.
- g) An institutional control approved under this Section shall not become effective until the site owner's duties under subsection (c) of this Section are officially recorded in accordance with subsection (e) of this Section. The person receiving the approval shall obtain and submit to the Agency a certified copy of the institutional control as recorded.

- h) The following shall be grounds for voidance of the ordinance as an institutional control and the Agency's "No Further Remediation" determination:
- 1) Modification of the ordinance by the unit of local government to allow potable use of groundwater;
 - 2) Approval of a site-specific request, such as a variance, to allow potable use of groundwater at a site identified in subsection (b) (4) of this Section; and
 - 3) Violation of the terms of an institutional control recorded under Section 742.905 or Section 742.910.

Section 742.920 Highway Authority Agreements

- a) An agreement with a highway authority may be used as an institutional control where the requirements of this Section are met and the Agency has determined that "no further remediation" is required as to the property(ies) to which the agreement is to apply.
- b) As part of the agreement the highway authority shall agree to prohibit:
- 1) The use of groundwater under the highway right of way that is contaminated above Tier 1 levels from the release as a potable supply of water.
 - 2) Access to soil contamination under the highway right of way that is contaminated above Tier 1 levels from the release.
- c) A request for approval of an agreement as an institutional control shall provide the following:
- 1) A copy of the agreement executed by the highway authority and the owner of the property from which the release occurred;
 - 2) A scaled map delineating the horizontal and vertical extent of soil and groundwater contamination above the applicable Tier 1 cleanup objectives;
 - 3) Information showing the concentration of contaminants within the zone in which the applicable Tier 1 cleanup objectives are exceeded;
 - 4) A stipulation of the information required by subsection (b) (2) and (b) (3) of this Section in

the agreement if it is not practical to obtain the information by sampling the highway right-of-way; and

- 5) Information identifying the current fee owner of the highway right-of-way and highway authority having jurisdiction.
- d) Violation of the terms of an Agreement approved by the Agency as an institutional control under this Section shall be grounds for voidance of the Agreement as an institutional control and the Agency's "No Further Remediation" determination.

SUBPART J: ENGINEERED BARRIERS

Section 742.1000 General

- a) Any person who develops cleanup objectives under this Part based on engineered barriers shall meet the requirements of this Subpart and the requirements of Subpart I relative to institutional controls.
- b) The Agency shall not approve any cleanup objective under this Part that is based on the use of engineered barriers unless the person has proposed engineered barriers meeting the requirements of this Subpart.
- c) The use of engineered barriers can be recognized in calculating cleanup objectives only if they are intended for use as part of the final corrective action.
- d) Any "No Further Remediation" determination based upon the use of engineered barriers shall require effective maintenance of the engineered barrier. The maintenance requirements shall be included in an institutional control under Subpart I.
- e) Failure to maintain an engineered barrier in accordance with the "No Further Remediation" determination shall be grounds for voidance of the determination.

Section 742.1005 Engineered Barrier Requirements

- a) Natural attenuation, access controls, and point of use treatment shall not be considered engineered barriers.
- b) For purposes of determining cleanup objectives under Tier 1, engineered barriers are not recognized.
- c) The following engineered barriers are recognized for

purposes of calculating cleanup objectives that exceed residential cleanup objectives:

- 1) For the soil to groundwater migration route, the following engineered barriers are applicable:
 - A) Caps, covering the contaminated media, constructed of compacted clay, asphalt, concrete or other material approved by the Agency;
 - B) Slurry walls; and
 - C) Permanent structures such as buildings and highways.
- 2) For the inhalation and ingestion routes, the following engineered barriers are applicable:
 - A) Caps, covering the contaminated media, constructed of compacted clay, asphalt, concrete, or other material approved by the Agency;
 - B) Permanent structures such as buildings and highways; and
 - C) Clean soil, covering the contaminated media, that is a minimum of one (1) meter in depth.
- d) Unless otherwise prohibited under Section 742.1000, any type of engineered barrier may be proposed under Tier 3.

Section 742.APPENDIX A: General

TABLE A: Soil Saturation Limits (C_{sat}) for Chemicals Whose Melting Point is Less than 30° C.

Chemical Name	C_{sat} (mg/kg)
Acetone	62,000
Benzene	860
Bis(2-chloroethyl)ether	6,600
Bis(2-ethylhexyl)phthalate	210
Bromodichloromethane (Dichlorobromomethane)	1,800
Bromoform	2,800
Butanol	9,700
Butyl benzyl phthalate	530
Carbon disulfide	1,400
Carbon tetrachloride	1,000
Chlorobenzene (Monochlorobenzene)	560
Chlorodibromomethane (Dibromochloromethane)	1,900
Chloroform	3,700
1,2-Dibromo-3-chloropropane	1,000
1,2-Dibromoethane (Ethylene dibromide)	1,900
Di-n-butyl phthalate	100
1,2-Dichlorobenzene (o-Dichlorobenzene)	300
1,1-Dichloroethane	2,400
1,2-Dichloroethane (Ethylene dichloride)	2,800
1,1-Dichloroethylene	2,000
cis-1,2-Dichloroethylene	1,500
trans-1,2-Dichloroethylene	3,600
1,2-Dichloropropane	750
1,3-Dichloropropene (1,3-Dichloropropylene, cis + trans)	400

Chemical Name	C _{max} (mg/kg)
Diethyl phthalate	520
Dimethyl phthalate	1,600
Di-n-octyl phthalate	1E+6
Ethylbenzene	260
Hexachlorocyclopentadiene	88
Isophorone	3,400
Methyl bromide (Bromomethane)	3,800
Methylene chloride (Dichloromethane)	3,700
Nitrobenzene	1,700
Styrene	1,400
Tetrachloroethylene (Perchloroethylene)	47
Toluene	520
1,2,4-Trichlorobenzene	290
1,1,1-Trichloroethane	980
1,1,2-Trichloroethane	2,500
Trichloroethylene	880
Vinyl acetate	3,000
Vinyl chloride	2,200
Xylenes (total)	320
Ionizable Organics	
2-Chlorophenol	53,000

Section 742.APPENDIX A: General

TABLE B: Tolerance Factor (K)

Tolerance factors (K) for one-sided normal tolerance intervals with probability level (confidence factor) $Y = 0.95$ and coverage $P = 95\%$. n = number of samples collected.

n	K	n	K
3	7.655	200	1.836
4	5.145	225	1.824
5	4.202	250	1.814
6	3.707	275	1.806
7	3.399	300	1.799
8	3.188	325	1.792
9	3.031	350	1.787
10	2.911	375	1.782
11	2.815	400	1.777
12	2.736	425	1.773
13	2.670	450	1.769
14	2.614	475	1.766
15	2.566	500	1.763
16	2.523	525	1.760
17	2.486	550	1.757
18	2.543	575	1.754
19	2.423	600	1.752
20	2.396	625	1.750
21	2.371	650	1.748
22	2.350	675	1.746
23	2.329	700	1.744
24	2.309	725	1.742
25	2.292	750	1.740
30	2.220	775	1.739
35	2.166	800	1.737
40	2.126	825	1.736
45	2.092	850	1.734
50	2.065	875	1.733
55	2.036	900	1.732
60	2.017	925	1.731
65	2.000	950	1.729
70	1.986	975	1.728
75	1.972	1000	1.727
100	1.924		
125	1.891		
150	1.868		
175	1.850		

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Section 742.APPENDIX A: General

TABLE C: SSL Chemicals with Noncarcinogenic Toxic Effects on Specific Target Organs/Organ Systems or Similar Modes of Action

Kidney

Acetone
Dalapon
1,1-Dichloroethane
Dimethyl phthalate
2,6-Dinitrotoluene
Di-n-octyl phthalate
Nitrobenzene
2,4,5-Trichlorophenol
Vinyl acetate

Liver

Acetone
Chlorobenzene
Di-n-octyl phthalate
Nitrobenzene
Picloram
2,4,5-TP (Silvex)
2,4,5-Trichlorophenol

Central Nervous System

Butanol
2,4-Dichlorophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Manganese
2-Methylphenol

Circulatory System

Antimony
Barium
p-Chloroaniline
2,4-D
cis-1,2-Dichloroethylene
Nitrobenzene
Zinc

Reproductive System

Carbon disulfide
2-Chlorophenol
1,2,4-Trichlorobenzene
Dinoseb

Gross Pathology

Diethyl phthalate
2-Methylphenol
Naphthalene
Nickel
Vinyl acetate

Cholinesterase Inhibition

Aldicarb
Carbofuran

**Decreased Body Weight Gains
and Circulatory System Effects**

Atrazine
Simazine

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Section 742.APPENDIX A: General

TABLE D: Range of Concentrations of Inorganic Chemicals in Background Soils

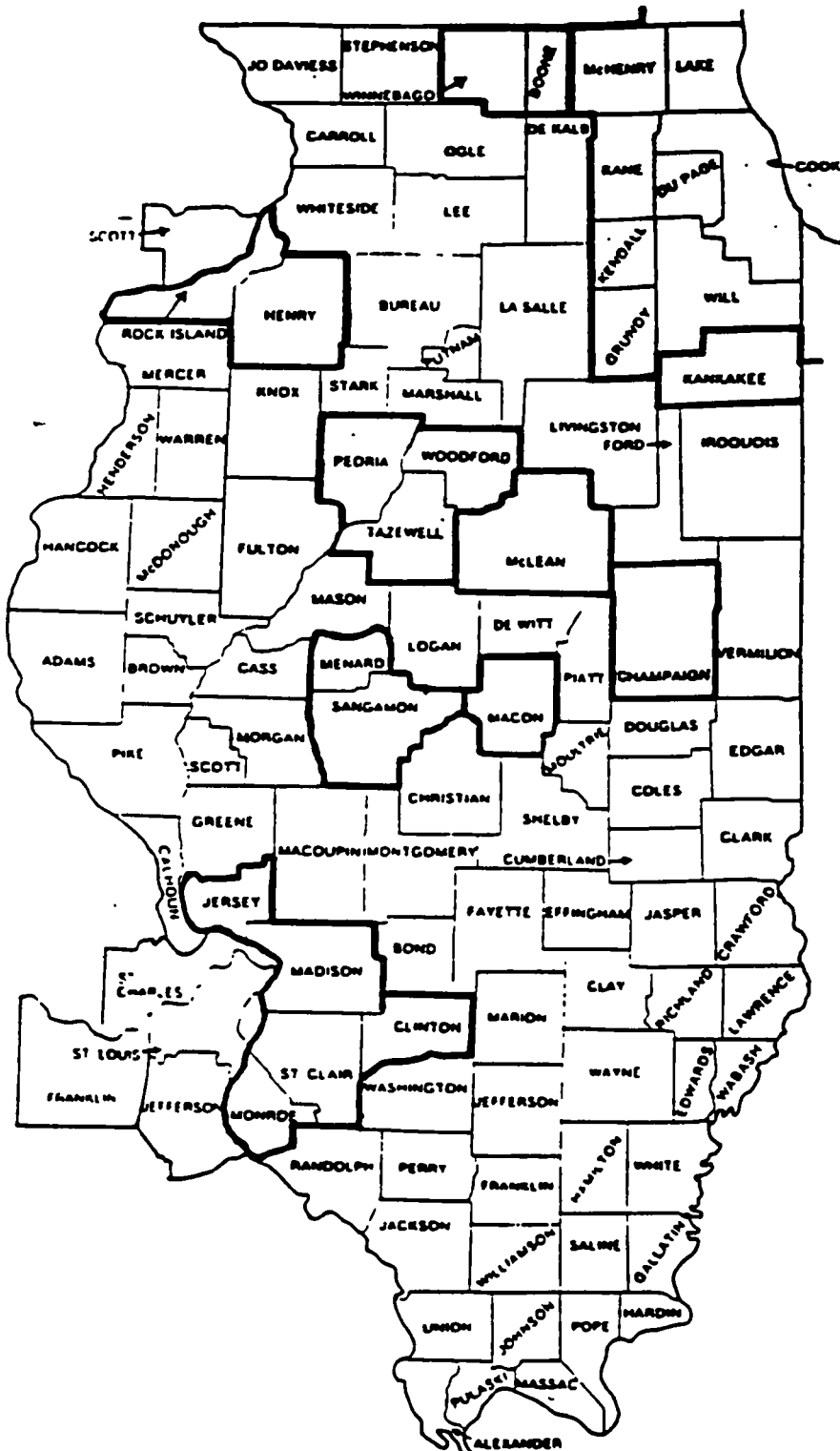
Chemical Name	Counties Within Metropolitan Statistical Areas (mg/kg)	Counties Outside Metropolitan Statistical Areas (mg/kg)
Aluminum -	1,388 - 37,200	2,640 - 23,300
Antimony	0.24 - 8	0.18 - 8.6
Arsenic	1.1 - 2.4	0.35 - 22.4
Barium	ND ¹ (<5) - 1,720	22.4 - 253
Beryllium	0.05 - 9.9	ND (<0.02) - 8.8
Cadmium	ND (<2.5) - 8.2	ND (<0.2) - 5.2
Calcium	813 - 130,000	630 - 184,000
Chromium	ND (<2.14) - 151	4.3 - 37
Cobalt	2.1 - 23	0.9 - 32
Copper	ND (<2.93) - 156	1 - 42
Cyanide	ND (<0.07) - 2.7	ND (<0.6) - 1.2
Iron	5,000 - 80,000	3,200 - 29,100
Lead	4.7 - 647	ND (<7.44) - 270
Magnesium	541 - 74,500	476 - 24,100
Manganese	155 - 5,590	61.5 - 3,710
Mercury	0.02 - 0.99	ND (<0.01) - 1.67
Nickel	ND (<3.1) - 135	ND (<5) - 34.6
Potassium	270 - 5,820	280 - 5,600
Selenium	ND (<0.12) - 2.6	ND (<0.1) - 1.7
Silver	ND (<0.32) - 5.6	ND (<0.06) - 5.9
Sodium	20.2 - 1,290	14.1 - 7,600

¹ ND = Below the Detection Limit

Chemical Name	Counties Within Metropolitan Statistical Areas (mg/kg)	Counties Outside Metropolitan Statistical Areas (mg/kg)
Sulfate	17.6 - 240	10 - 260
Sulfide	ND (<1.00) - 10.1	ND (<1) - 8.8
Thallium	0.02 - 1.6	0.05 - 2.8
Vanadium	ND (<2.5) - 80	6 - 47
Zinc	23 - 798	ND (<5.5) - 400

Section 742.APPENDIX A: General

Illustration A: Illinois Metropolitan Statistical Areas



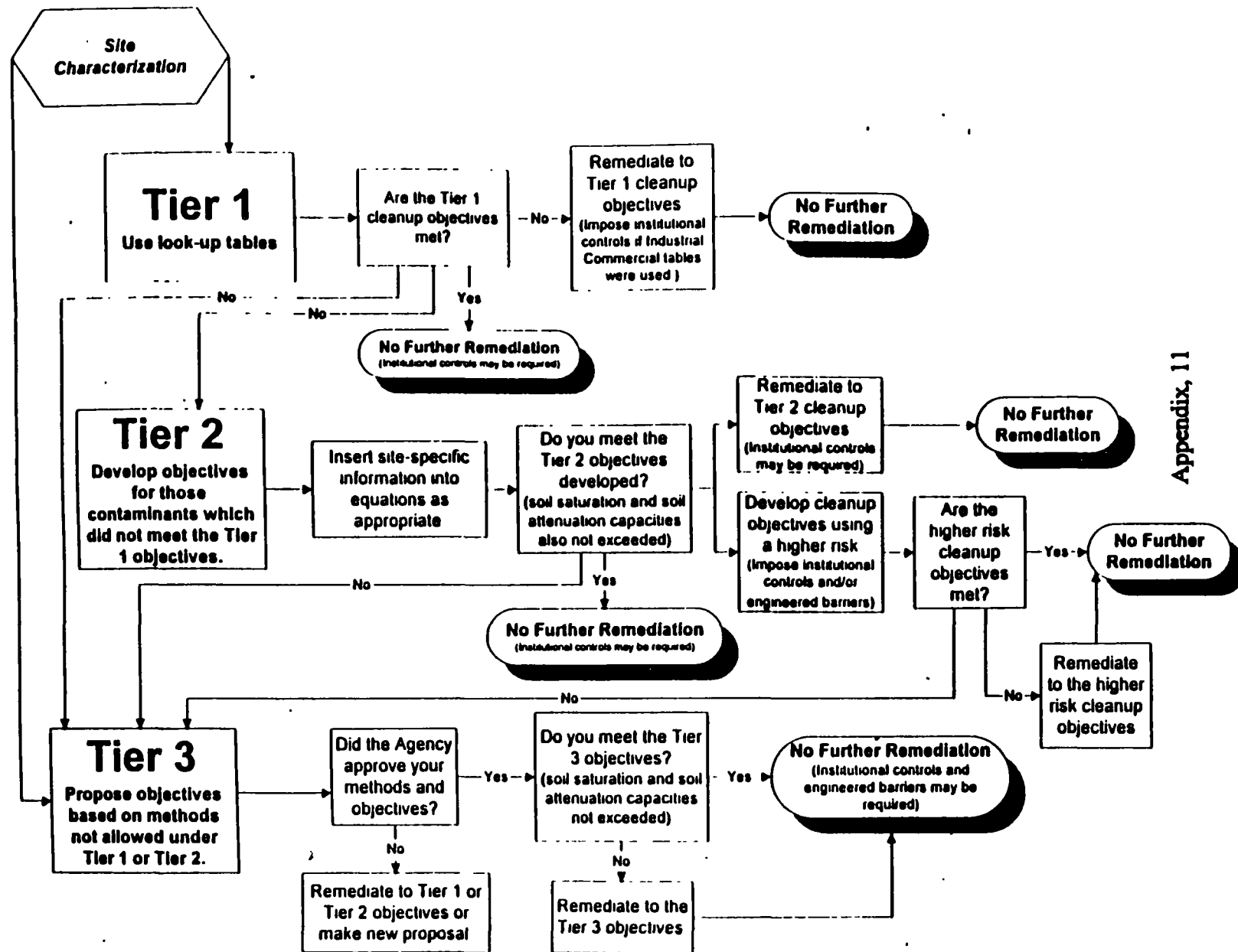
Aurora-Egin, IL PMSA
 Kane & Kendall Counties, IL
 Bloomington-Normal, IL MSA
 McLean County, IL
 Champaign-Urbana-Rantoul, IL MSA
 Champaign County, IL
 Chicago, IL PMSA
 Cook, DuPage, & McHenry Counties, IL
 Chicago-Gary-Lake Cnty, IL-IN-WI CMSA
 Aurora-Egin, IL PMSA
 Chicago, IL PMSA
 Gary-Hammond, IN PMSA (Lake & Porter Cntys., IN)
 Joliet, IL PMSA
 Kenosha, WI PMSA (Kenosha Cnty., WI)
 Lake County, IL PMSA
 Davenport-Rock Island-Moline, IA-IL MSA
 Henry & Rock Island Counties, IL (Scott Cnty, IA)
 Decatur, IL MSA
 Macon County, IL
 Joliet, IL PMSA
 Grundy & Will Counties, IL
 Kankakee, IL MSA
 Kankakee County, IL
 Lake County, IL PMSA
 Lake County, IL
 Peoria, IL MSA
 Peoria, Tazewell, & Woodford Counties, IL
 Rockford, IL MSA
 Boone & Winnebago Counties, IL
 St. Louis, MO-IL MSA
 Clinton, Jersey, Madison, Monroe, & St. Clair Counties, IL
 Franklin, Jefferson, St. Charles, & St. Louis Cntys., MO;
 St. Louis City, MO)
 Springfield, IL MSA
 Menard & Sangamon Counties, IL

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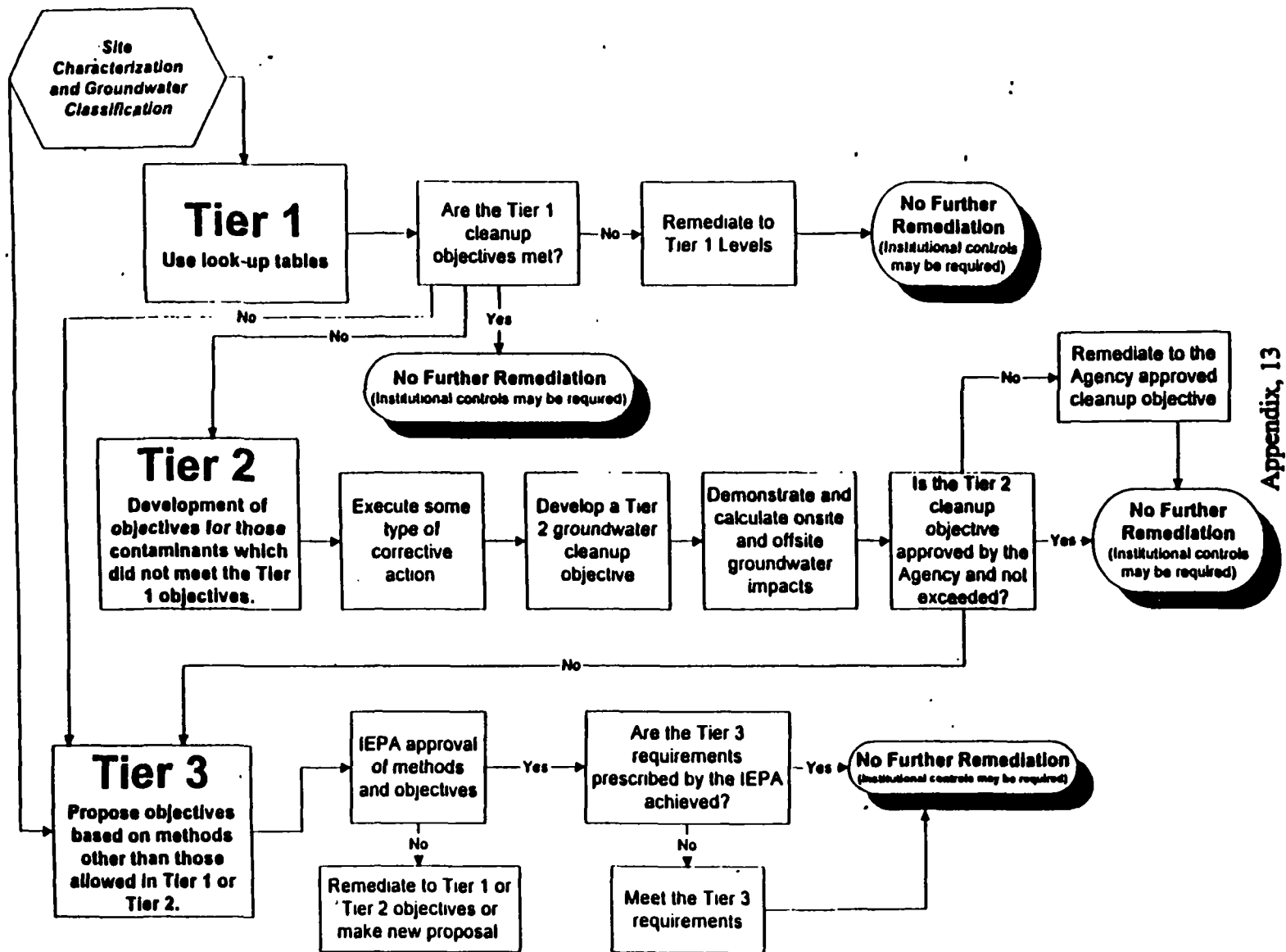
General

Illustration B: Developing Tiered Cleanup Objectives for Soil



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Illustration C: Developing Tiered Cleanup Objectives for Groundwater



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Section 742.APPENDIX B: Tier 1 Tables and Illustrations

TABLE A: Tier 1 Soil Cleanup Objectives for Residential Properties

CAS No.	Chemical Name	Route-Specific Values for Surface Soils		Migration to Groundwater Route Values		ADL (mg/kg)
		Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	
83-32-9	Acenaphthene	4,700 ^b	--- ^c	200 ^b	1,000	*
67-64-1	Acetone	7,800 ^b	62,000 ^d	8 ^b	8	*
15972-60-8	Alachlor ^e	8 ^e	--- ^c	0.012	0.06	NA
116-06-3	Aldicarb ^e	78 ^b	--- ^c	0.036	0.18	NA
309-00-2	Aldrin	0.04 ^e	0.5 ^e	0.005 ^e	0.025	*
120-12-7	Anthracene	23,000 ^b	--- ^c	4,300 ^b	21,500	*
1912-24-9	Atrazine ^e	2700 ^b	--- ^c	0.015	0.075	NA
71-43-2	Benzene	22 ^e	0.5 ^e	0.02	0.1	*
56-55-3	Benzo(a)anthracene	0.9 ^e	--- ^c	0.7	3.5	*
205-99-2	Benzo(b)fluoranthene	0.9 ^e	--- ^c	4	20	*
207-08-9	Benzo(k)fluoranthene	9 ^e	--- ^c	4	20	*
50-32-8	Benzo(a)pyrene	0.09 ^{e,f}	--- ^c	4	40	*
111-44-4	Bis(2-chloroethyl)ether	0.6 ^e	0.3 ^{e,f}	0.0003 ^{e,f}	0.0003	0.66

CAS No.	Chemical Name	Route-Specific Values for Surface Soils		Migration to Groundwater Route Values		ADL (mg/kg)
		Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	
117-81-7	Bis(2-ethylhexyl)phthalate	46 ^c	210 ^d	11	110	*
75-27-4	Bromodichloromethane (Dichlorobromomethane)	5 ^c	1,800 ^d	0.3	1.5	*
75-25-2	Bromoform	81 ^c	46 ^c	0.5	0.5	*
71-36-3	Butanol	7,800 ^b	9,700 ^d	8 ^b	8	NA
85-68-7	Butyl benzyl phthalate	16,000 ^b	530 ^d	68	340	*
86-74-8	Carbazole	32 ^c	--- ^c	---	---	NA
1563-66-2	Carbofuran ^a	390 ^b	--- ^c	0.21	1.05	NA
75-15-0	Carbon disulfide	7,800 ^b	11 ^b	14 ^b	70	*
56-23-5	Carbon tetrachloride	5 ^c	0.2 ^c	0.03	0.15	*
57-74-9	Chlordane	0.5 ^c	10 ^c	2	10	*
108-90-7	Chlorobenzene (Monochlorobenzene)	1,600 ^b	94 ^b	0.6	3.0	*
124-48-1	Chlorodibromomethane (Dibromochloromethane)	1,400 ^b	--- ^c	0.2	1.0	*
67-66-3	Chloroform	110 ^c	0.2 ^c	0.3	1.5	*
218-01-9	Chrysene	88 ^c	--- ^c	1	5.0	*

CAS No.	Chemical Name	Route-Specific Values for Surface Soils		Migration to Groundwater Route Values		ADL (mg/kg)
		Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	
94-75-7	2,4-D	780 ^b	--- ^c	1.7	8.5	*
75-99-0	Dalapon	2,300 ^b	--- ^c	0.14	1.4	1.2
72-54-8	DDD	3 ^a	--- ^c	0.7 ^a	3.5	*
72-55-9	DDE	2 ^a	--- ^c	0.5 ^a	2.5	*
50-29-3	DDT	2 ^a	80 ^a	1 ^a	5.0	*
53-70-3	Dibenzo(a,h)anthracene	0.09 ^{a,f}	--- ^c	11	55	*
96-12-8	1,2-Dibromo-3-chloropropane	0.46 ^a	1.9 ^b	0.00061	0.00061	*
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	0.0075 ^a	0.0058 ^a	0.00018	0.0018	0.005
84-74-2	Di-n-butyl phthalate	7,800 ^b	100 ^d	100 ^d	100 ^d	*
95-50-1	1,2-Dichlorobenzene (o - Dichlorobenzene)	7,000 ^b	300 ^d	6	15	*
106-46-7	1,4-Dichlorobenzene (p - Dichlorobenzene)	27 ^a	7,700 ^b	1	5.0	*
91-94-1	3,3'-Dichlorobenzidine	1 ^a	--- ^c	0.01 ^{a,f}	0.05 ^{a,f}	1.3
75-34-3	1,1-Dichloroethane	7,800 ^b	980 ^b	11 ^b	55	*
107-06-2	1,2-Dichloroethane (Ethylene dichloride)	7 ^a	0.3 ^a	0.01 ^f	0.05	*

CAS No.	Chemical Name	Route-Specific Values for Surface Soils		Migration to Groundwater Route Values		ADL (mg/kg)
		Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	
75-35-4	1,1-Dichloroethylene ²	630 ^b	--- ^c	0.03	0.15	*
156-59-2	<i>cis</i> -1,2-Dichloroethylene	780 ^b	1,500 ^d	0.2	0.6	*
156-60-5	<i>trans</i> -1,2-Dichloroethylene	1,600 ^b	3,600 ^d	0.3	1.5	*
78-97-5	1,2-Dichloropropane	9 ^c	11 ^b	0.02	0.1	*
542-75-6	1,3-Dichloropropene (1,3-Dichloropropylene, <i>cis</i> + <i>trans</i>)	4 ^c	0.1 ^c	0.001 ^{c,f}	0.005	0.005
60-57-1	Dieldrin ^a	0.04 ^c	2 ^c	0.001 ^{c,f}	0.005	0.0013
84-66-2	Diethyl phthalate	63,000 ^b	520 ^d	110 ^b	110	*
131-11-3	Dimethyl phthalate ²	780,000 ^b	1,600 ^d	1,200 ^b	1,200	*
121-14-2	2,4-Dinitrotoluene	160 ^b	--- ^c	0.2 ^{b,f}	0.2	*
606-20-2	2,6-Dinitrotoluene ²	78 ^b	--- ^c	0.1 ^{b,f}	0.1	*
88-85-7	Dinoseb ^a	78 ^b	--- ^c	0.017	0.17	*
117-84-0	Di- <i>n</i> -octyl phthalate	1,600 ^b	--- ^c	--- ^g	--- ^g	*
115-29-7	Endosulfan	470 ^b	--- ^c	4 ^b	4	*
145-73-3	Endothall ^a	1,600 ^b	--- ^c	0.22	0.22	NA
72-20-8	Endrin	23 ^b	--- ^c	0.4	2.0	*

		Route-Specific Values for Surface Soils		Migration to Groundwater Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
100-41-4	Ethylbenzene	7,800 ^b	260 ^d	5	7	*
206-44-0	Fluoranthene	3,100 ^b	--- ^c	980 ^b	4,900	*
86-73-7	Fluorene	3,100 ^b	--- ^c	160 ^b	800	*
76-44-8	Heptachlor	0.1 ^e	0.3 ^e	0.06	0.3	*
1024-57-3	Heptachlor epoxide	0.07 ^e	1 ^e	0.03	0.15	*
118-74-1	Hexachlorobenzene	0.4 ^e	1 ^e	0.8	8	*
319-84-6	<i>alpha</i> -HCH (<i>alpha</i> -BHC)	0.1 ^e	0.9 ^e	0.0004 ^{e,f}	0.002	0.002
58-89-9	<i>gamma</i> -HCH (Lindane) ^a	0.5 ^e	--- ^c	0.006	0.03	*
77-47-4	Hexachlorocyclopentadiene	550 ^b	2 ^b	10	88 ^d	*
67-72-1	Hexachloroethane	78 ^b	--- ^c	0.3 ^{b,f}	0.3	*
193-39-5	Indeno(1,2,3- <i>c,d</i>)pyrene	0.9 ^e	--- ^c	35	175	*
78-59-1	Isophorone	15,600 ^b	--- ^c	4 ^b	4	*
72-43-5	Methoxychlor	390 ^b	--- ^c	62	310	*
74-83-9	Methyl bromide (Bromomethane)	110 ^b	2 ^b	0.1 ^b	0.1	*
75-09-2	Methylene chloride (Dichloromethane)	85 ^e	7 ^e	0.01 ^f	0.1	*

CAS No.	Chemical Name	Route-Specific Values for Surface Soils		Migration to Groundwater Route Values		ADL (mg/kg)
		Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	
91-20-3	Naphthalene ²	3,100 ^b	--- ^c	30 ^b	47	*
98-95-3	Nitrobenzene ²	39 ^b	110 ^b	0.09 ^{b,f}	0.09	0.26
1918-02-1	Picloram ^o	5,500 ^b	--- ^c	1.1	11	NA
1336-36-3	Polychlorinated biphenyls (PCBs) ^o	1; 10 ^b	--- ^{c,h}	--- ^b	--- ^b	*
129-00-0	Pyrene	2,300 ^b	--- ^c	1,400 ^b	7,000	*
122-34-9	Simazine ^o	390 ^b	--- ^c	0.02	0.2	NA
100-42-5	Styrene	16,000 ^b	1,400 ^d	2	10	*
93-72-1	2,4,5-TP (Silvex)	630 ^b	--- ^c	2.7	13.5	*
127-18-4	Tetrachloroethylene (Perchloroethylene)	12 ^e	11 ^e	0.04	0.2	*
108-88-3	Toluene	16,000 ^b	520 ^d	5	12.5	*
8001-35-2	Toxaphene ^a	0.6 ^e	5 ^d	0.04 ^f	0.2	0.058
120-82-1	1,2,4-Trichlorobenzene	780 ^b	240 ^b	2	20	*
71-55-6	1,1,1-Trichloroethane ²	--- ^c	980 ^d	0.9	4.5	*
79-00-5	1,1,2-Trichloroethane	310 ^b	--- ^c	0.01 ^f	0.1	*

CAS No.	Chemical Name	Route-Specific Values for Surface Soils		Migration to Groundwater Route Values		ADL (mg/kg)
		Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	
79-01-6	Trichloroethylene	58 ^c	3 ^c	0.02	0.1	*
108-05-4	Vinyl acetate	78,000 ^b	370 ^b	84 ^b	84	*
75-01-4	Vinyl chloride	0.3 ^c	0.002 ^{e,f}	0.01 ^f	0.05	*
1330-20-7	Xylenes (total)	160,000 ^b	320 ^d	74	74	*
	Ionizable Organics					
65-85-0	Benzoic Acid	310,000 ^b	--- ^c	280 ^{b,i}	280	*
106-47-8	4-Chloroaniline (<i>p</i> -Chloroaniline)	310 ^b	--- ^c	0.3 ^{b,f}	0.3	1.3
95-57-8	2-Chlorophenol	390 ^b	53,000 ^d	2 ^b	2	*
120-83-2	2,4-Dichlorophenol	240 ^b	--- ^c	0.5 ^b	0.5	*
105-67-9	2,4-Dimethylphenol	1,600 ^b	--- ^c	3 ^b	3	*
51-28-5	2,4-Dinitrophenol	160 ^b	--- ^c	0.1 ^{b,f}	0.1	3.3
95-48-7	2-Methylphenol (<i>o</i> - Cresol)	3,900 ^b	--- ^c	6 ^b	6	*
86-30-6	<i>N</i> -Nitrosodiphenylamine	130 ^c	--- ^c	0.2 ^{e,f}	0.2	0.66
621-64-7	<i>N</i> -Nitrosodi- <i>n</i> -propylamine	0.09 ^{e,f}	--- ^c	0.00002 ^{e,f}	0.00002	0.66
87-86-5	Pentachlorophenol	3 ^{e,j}	--- ^c	0.01 ^{f,i}	0.05	2.4

CAS No.	Chemical Name	Route-Specific Values for Surface Soils		Migration to Groundwater Route Values		ADL (mg/kg)
		Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	
108-95-2	Phenol	47,000 ^b	--- ^c	49 ^{a,1}	49	*
95-95-4	2,4,5-Trichlorophenol	7,800 ^b	--- ^c	120 ^{a,1}	600	*
88-06-2	2,4,6 Trichlorophenol	58 ^c	210 ^c	0.06 ^{a,1}	0.06	0.43

		Route-specific Values for Surface Soils		Migration to Groundwater Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/L) TCLP	Class II (mg/L) TCLP	ADL (mg/kg)
	Inorganics					
7440-36-0	Antimony	31 ^b	--- ^c	0.004 ^m	0.024 ^m	*
7440-38-2	Arsenic ^{1,a}	0.4 ^c	380 ^c	0.05 ^m	0.2 ^m	*
7440-39-3	Barium	5,500 ^b	350,000 ^b	2.0 ^m	2.0 ^m	*
7440-41-7	Beryllium	0.1 ^c	690 ^c	0.004 ^m	0.5 ^m	*
7440-42-8	Boron	7,000 ^b	--- ^c	2.0 ^m	2.0 ^m	*
7440-43-9	Cadmium ^{1,a}	39 ^b	920 ^c	0.005 ^m	0.05 ^m	*
16887-00-6	Chloride	--- ^c	--- ^c	200 ^m	200 ^m	*
7440-47-3	Chromium, total	--- ^c	--- ^c	0.1 ^m	1.0 ^m	*
18540-29-9	Chromium, ion, hexavalent	390 ^b	140 ^c	---	---	*
7440-48-4	Cobalt	4,700 ^b	--- ^c	1.0 ^m	1.0 ^m	*
7440-50-8	Copper ^a	2,900 ^b	--- ^c	0.65 ^m	0.65 ^m	*
57-12-5	Cyanide	1,600 ^b	--- ^c	0.2 ^q	0.6 ^q	*
7782-41-4	Fluoride	4,700 ^b	--- ^c	4.0 ^m	4.0 ^m	*
15438-31-0	Iron	--- ^c	--- ^c	5.0 ^m	5.0 ^m	*

CAS No.	Chemical Name	Route-specific Values for Surface Soils		Migration to Groundwater Route Values		ADL (mg/kg)
		Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/L) TCLP	Class II (mg/L) TCLP	
7439-92-1	Lead	400 ^b	--- ^c	0.0075 ^m	0.1 ^m	*
7439-96-5	Manganese	3,900 ^b	35,400 ^b	0.15 ^m	10.0 ^m	*
7439-97-6	Mercury ^{1,a}	23 ^b	7 ^{b,1}	0.002 ^m	0.01 ^m	*
7440-02-0	Nickel ¹	1,600 ^b	6,900 ^b	0.1 ^m	2.0 ^m	*
14797-55-8	Nitrate as N ^p	130,000 ^b	--- ^c	10.0 ^m	100 ^m	*
7782-49-2	Selenium ^{1,a}	390 ^b	--- ^c	0.05 ^m	0.05 ^m	*
7440-22-4	Silver	390 ^b	--- ^c	0.05 ^m	---	*
14808-79-8	Sulfate	--- ^c	--- ^c	400 ^m	400 ^m	*
7440-28-0	Thallium	6 ^b	--- ^c	0.002 ^m	0.02 ^m	*
7440-62-2	Vanadium ²	550 ^b	--- ^c	0.049 ^m	---	*
7440-66-6	Zinc ¹	23,000 ^b	--- ^c	5.0 ^b	10 ^b	*

** indicates that the ADL is less than or equal to the specified cleanup objective.
NA means not available; no PQL or EQL available in USEPA analytical methods.

Chemical Name and Soil Cleanup Objective Notations

- Soil remediation objectives based on human health criteria only.
- Calculated values correspond to a target hazard quotient of 1
- No toxicity criteria available for the route of exposure.
- Soil saturation concentration (C_{sa}) = the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached. Above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required.
- Calculated values correspond to a cancer risk level of 1 in 1,000,000.
- Level is at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).
- Chemical-specific properties are such that this route is not of concern at any soil contaminant concentration.
- A preliminary goal of 1 ppm has been set for PCBs based on *Guidance on Remedial Actions for Superfund Sites with PCB Contamination*, EPA/540G-90/007, and on USEPA efforts to manage PCB contamination. See 40 CFR 761.120 - USEPA "PCB Spill Cleanup Policy." This regulation goes on to say that the cleanup goal for an unrestricted area is 10 ppm and 25 ppm for a restricted area, provided both have at least 10 inches of clean cover.
- Soil remediation objective for pH of 6.8. If soil pH is other than 6.8, refer to Appendix B, Tables C and D of Part 742.
- Ingestion soil remediation objective adjusted by a factor of 0.5 to account for dermal route.
- A preliminary remediation goal of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER Directive #9355.4-12.
- Potential for soil-plant-human exposure.
- Concentration in mg/L determined by the Toxicity Characteristic Leaching Procedure (TCLP). The person conducting the remediation has the option to use TCLP objectives listed in this Table or the applicable pH-specific soil cleanup objective listed in Appendix, Tables C or D. If the person conducting the remediation wishes to calculate soil cleanup objectives based on background concentrations, this should be done in accordance with Subpart C of Part 742.
- The Agency reserves the right to evaluate the potential for remaining contaminant concentrations to pose significant threats to crops, livestock, or wildlife.
- For agrichemical facilities, cleanup objectives for surficial soils which are based on field application rates may be more appropriate for currently registered pesticides. Consult the Agency for further information.
- For agrichemical facilities, soil cleanup objectives based on site-specific background concentrations of Nitrate as N may be more appropriate. Such determinations shall be conducted in accordance with the Tier 3 evaluation procedures set forth in Subpart H of Part 742.
- For cyanide, the TCLP extraction must be done using water at a pH of 7.0.

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Section 742.APPENDIX B: Tier 1 Tables and Illustrations

Table B: Tier 1 Soil Cleanup Objectives for Industrial/Commercial Properties

CAS No.	Chemical Name	Route-Specific Values for Surface Soils				Migration to Groundwater Route Values		ADL (mg/kg)
		Industrial-Commercial		Construction Worker		Class I (mg/kg)	Class II (mg/kg)	
		Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)			
83-32-9	Acenaphthene	120,000 ^a	----- ^c	120,000 ^a	----- ^c	200 ^a	1,000	•
67-64-1	Acetone	200,000 ^a	62,000 ^d	200,000 ^a	62,000 ^d	8 ^a	8	•
15972-60-8	Alachlor ^a	72 ^a	----- ^c	1,000 ^a	----- ^c	0.012	0.06	NA
116-06-3	Aldicarb ^a	2,000 ^a	----- ^c	200 ^a	----- ^c	0.036	0.18	NA
309-00-2	Aldrin	0.3 ^a	0.8 ^a	5 ^a	9 ^a	0.005 ^a	0.025	•
120-12-7	Anthracene	610,000 ^a	----- ^c	610,000 ^a	----- ^c	4,300 ^a	21,500	•
1912-24-9	Atrazine ^a	72,000 ^a	----- ^c	7,200 ^a	----- ^c	0.015	0.075	NA
71-43-2	Benzene	200 ^a	0.9 ^a	2,900 ^a	0.9 ^a	0.02	0.1	•
56-55-3	Benzo(a)anthracene	8 ^a	----- ^c	110 ^a	----- ^c	0.7	3.5	•
205-99-2	Benzo(b)fluoranthene	8 ^a	----- ^c	110 ^a	----- ^c	4	20	•
207-08-9	Benzo(k)fluoranthene	78 ^a	----- ^c	1,100 ^a	----- ^c	4	20	•
50-32-8	Benzo(a)pyrene	0.8 ^a	----- ^c	11 ^a	----- ^c	4	40	•
111-44-4	Bis(2-chloroethyl)ether	5 ^a	0.5 ^a	75 ^a	5 ^a	0.0003 ^{a,f}	0.0003	0.66
117-81-7	Bis(2-ethylhexyl)phthalate	410 ^a	210 ^d	5,900 ^a	210 ^d	11	110	•

CAS No.	Chemical Name	Route-Specific Values for Surface Soils				Migration to Groundwater Route Values		ADL (mg/kg)
		Industrial-Commercial		Construction Worker		Class I (mg/kg)	Class II (mg/kg)	
		Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)			
75-27-4	Bromodichloromethane (Dichlorobromomethane)	92*	1,800*	640*	1,800*	0.3	1.5	*
75-25-2	Bromoform	720*	71*	11,000*	750*	0.5	0.5	*
71-36-3	Butanol	200,000*	9,700*	210,000*	9,700*	8*	8	NA
85-68-7	Butyl benzyl phthalate	410,000*	530*	410,000*	530*	68	340	*
86-74-8	Carbazole	290*	-----*	4,100*	-----*	---	---	NA
1563-66-2	Carbofuran*	10,000*	-----*	1,000*	-----*	0.21	1.05	NA
75-15-0	Carbon disulfide	200,000*	13*	21,000*	1*	14*	70	*
56-23-5	Carbon tetrachloride	44*	0.3*	640*	4*	0.03	0.15	*
57-74-9	Chlordane	4*	15*	64*	160*	2	10	*
108-90-7	Chlorobenzene (Monochlorobenzene)	41,000*	120*	4,100*	9*	0.6	3.0	*
124-48-1	Chlorodibromomethane (Dibromochloromethane)	41,000*	-----*	41,000*	-----*	0.2	1.0	*
67-66-3	Chloroform	940*	0.3*	14,000*	4*	0.3	1.5	*
218-01-9	Chrysene	780*	-----*	11,000*	-----*	1	5.0	*
94-75-7	2,4-D	20,000*	-----*	2,000*	-----*	1.7	8.5	*
75-99-0	Dalapon	61,000*	-----*	6,000*	-----*	0.14	1.4	1.2
72-54-8	DDD	24*	-----*	350*	-----*	0.7*	3.5	*

CAS No.	Chemical Name	Route-Specific Values for Surface Soils				Migration to Groundwater Route Values		ADL (mg/kg)
		Industrial-Commercial		Construction Worker		Class I (mg/kg)	Class II (mg/kg)	
		Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)			
72-55-9	DDE	17 ^a	----- ^a	240 ^a	----- ^a	0.5 ^a	2.5	•
50-29-3	DDT	17 ^a	120 ^a	240 ^a	1,300 ^a	i ^a	5.0	•
53-70-3	Dibenzo(a,h)anthracene	0.8 ^a	----- ^a	11 ^a	----- ^a	11	55	•
96-12-8	1,2-Dibromo-3-chloropropane	4 ^a	430 ^a	59 ^a	120 ^a	0.00061	0.00061	•
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	0.07 ^a	0.09 ^a	1 ^a	0.01 ^a	0.00018	0.0018	0.003
84-74-2	Di-n-butyl phthalate	200,000 ^b	100 ^a	200,000 ^b	100 ^a	100 ^a	100 ^a	•
95-50-1	1,2-Dichlorobenzene (o - Dichlorobenzene)	180,000 ^b	300 ^a	18,000 ^b	180 ^a	6	15	•
106-46-7	1,4-Dichlorobenzene (p - Dichlorobenzene)	240 ^a	9,600 ^b	3,500 ^a	2,200 ^b	i	5.0	•
91-94-1	3,3'-Dichlorobenzidine	13 ^a	----- ^a	180 ^a	----- ^a	0.01 ^{a,j}	0.05 ^{a,j}	1.3
75-34-3	1,1-Dichloroethane	200,000 ^b	2,400 ^a	210,000 ^b	2,400 ^a	ii ^a	55	•
107-06-2	1,2-Dichloroethane (Ethylene dichloride)	63 ^a	0.4 ^a	910 ^a	0.5 ^a	0.01 ⁱ	0.05	•
75-35-4	1,1-Dichloroethylene	18,000 ^b	----- ^a	1,800 ^b	----- ^a	0.03	0.15	•
156-59-2	cis-1,2-Dichloroethylene	20,000 ^b	1,500 ^a	20,000 ^b	1,500 ^a	0.2	0.6	•
156-60-5	trans-1,2-Dichloroethylene	41,000 ^b	3,600 ^a	41,000 ^b	3,600 ^a	0.3	1.5	•
78-97-5	1,2-Dichloropropane	84 ^a	13 ^a	1,200 ^a	3 ^a	0.02	0.1	•

CAS No.	Chemical Name	Route-Specific Values for Surface Soils				Migration to Groundwater Route Values		ADL (mg/kg)
		Industrial-Commercial		Construction Worker		Class I (mg/kg)	Class II (mg/kg)	
		Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)			
542-75-6	1,3-Dichloropropene (1,3-Dichloropropylene, <i>cis</i> + <i>trans</i>)	33 ^a	0.2 ^a	460 ^a	2 ^a	0.001 ^{a,j}	0.005	0.005
60-57-1	Dieldrin ^a	0.4 ^a	3 ^a	5 ^a	28 ^a	0.001 ^{a,j}	0.005	0.0013
84-66-2	Diethyl phthalate	1,000,000 ^b	520 ^a	1,000,000 ^b	520 ^a	110 ^b	110	•
131-11-3	Dimethyl phthalate ¹	1,000,000 ^b	1,600 ^a	1,000,000 ^b	1,600 ^a	1,200 ^b	1,200	•
121-14-2	2,4-Dinitrotoluene	4,100 ^b	----- ^a	410 ^b	----- ^a	0.2 ^{a,j}	0.2	•
606-20-2	2,6-Dinitrotoluene ¹	2,000 ^b	----- ^a	2,000 ^b	----- ^a	0.1 ^{a,j}	0.1	•
88-85-7	Dinoseb ^a	2,000 ^b	----- ^a	200 ^b	----- ^a	0.017	0.17	•
117-84-0	Di-n-octyl phthalate	41,000 ^b	----- ^a	4,100 ^b	----- ^a	—	—	•
115-29-7	Endosulfan	12,000 ^b	----- ^a	1,200 ^b	----- ^a	4 ^b	4	•
145-73-3	Endothal ^a	41,000 ^b	----- ^a	4,100 ^b	----- ^a	0.22	0.22	NA
72-20-8	Endrin	610 ^b	----- ^a	61 ^b	----- ^a	0.4	2.0	•
100-41-4	Ethylbenzene	200,000 ^b	260 ^a	200,000 ^b	33 ^b	5	7	•
206-44-0	Fluoranthene	82,000 ^b	----- ^a	82,000 ^b	----- ^a	980 ^b	4,900	•
86-73-7	Fluorene	82,000 ^b	----- ^a	82,000 ^b	----- ^a	160 ^b	800	•
76-44-8	Heptachlor	1 ^a	0.5 ^a	18 ^a	6 ^a	0.06	0.3	•
1024-57-3	Heptachlor epoxide	0.6 ^a	2 ^a	9 ^a	23 ^a	0.03	0.15	•
118-74-1	Hexachlorobenzene	4 ^a	2 ^a	52 ^a	17 ^a	0.8	8	•

CAS No.	Chemical Name	Route-Specific Values for Surface Soils				Migration to Groundwater Route Values		ADL (mg/kg)
		Industrial-Commercial		Construction Worker		Class I (mg/kg)	Class II (mg/kg)	
		Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)			
319-84-6	<i>alpha</i> -HCH (<i>alpha</i> -BHC)	0.9 ^a	1.4 ^a	13 ^a	1.5 ^a	0.0004 ^{a,f}	0.002	0.002
58-89-9	<i>gamma</i> -HCH (Lindane) ^a	4 ^a	----- ^a	64 ^a	----- ^a	0.006	0.03	•
77-47-4	Hexachlorocyclopentadiene	14,000 ^b	3 ^b	14,000 ^b	2 ^b	10	88 ^a	•
67-72-1	Hexachloroethane	2,000 ^b	----- ^a	200 ^b	----- ^a	0.3 ^{b,f}	0.3	•
193-39-5	Indeno(1,2,3-c,d)pyrene	8 ^a	----- ^a	110 ^a	----- ^a	35	175	•
78-59-1	Isophorone	410,000 ^b	3,400 ^a	41,000 ^b	3,400 ^a	4 ^a	4	•
72-43-5	Methoxychlor	10,000 ^b	----- ^a	1,000 ^b	----- ^a	62	310	•
74-83-9	Methyl bromide (Bromomethane)	2,900 ^b	2.2 ^b	290 ^b	0.2 ^b	0.1 ^b	0.1	•
75-09-2	Methylene chloride (Dichloromethane)	760 ^a	11 ^a	11,000 ^a	120 ^a	0.01 ^f	0.1	•
91-20-3	Naphthalene	82,000 ^b	----- ^a	8,200 ^b	----- ^a	30 ^b	47	•
98-95-3	Nitrobenzene	1,000 ^b	140 ^b	1,000 ^b	10 ^b	0.09 ^{b,f}	0.09	0.26
1918-02-1	Picloram ^a	140,000 ^b	----- ^a	14,000 ^b	----- ^a	1.1	11	NA
1336-36-3	Polychlorinated biphenyls (PCBs) ^a	1; 10; 25 ^b	----- ^{a,b}	1 ^b	----- ^{a,b}	--- ^b	--- ^b	•
129-00-0	Pyrene	61,000 ^b	----- ^a	61,000 ^b	----- ^a	1,400 ^b	7,000	•
122-34-9	Simazine ^a	10,000 ^b	----- ^a	1,000 ^b	----- ^a	0.02	0.2	NA
100-42-5	Styrene	410,000 ^b	1,400 ^a	41,000 ^b	1,400 ^a	2	10	•

CAS No.	Chemical Name	Route-Specific Values for Surface Soils				Migration to Groundwater Route Values		ADL (mg/kg)
		Industrial-Commercial		Construction Worker		Class I (mg/kg)	Class II (mg/kg)	
		Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)			
93-72-1	2,4,5-TP (Silver)	16,000 ^a	----- ^c	20,000 ^a	----- ^c	2.7	13.5	•
127-18-4	Tetrachloroethylene (Perchloroethylene)	110 ^a	17 ^a	1,600 ^a	47 ^a	0.04	0.2	•
108-88-3	Toluene	410,000 ^a	520 ^a	410,000 ^a	27 ^a	5	12.5	•
8001-35-2	Toxaphene ^a	5.2 ^a	7 ^a	75 ^a	78 ^a	0.04 ^f	0.2	0.058
120-82-1	1,2,4-Trichlorobenzene	20,000 ^a	290 ^a	2,000 ^a	290 ^a	2	20	•
71-55-6	1,1,1-Trichloroethane ⁱ	----- ^c	980 ^a	----- ^c	980 ^a	0.9	4.5	•
79-00-5	1,1,2-Trichloroethane	8,200 ^a	----- ^c	8,200 ^a	----- ^c	0.01 ^f	0.1	•
79-01-6	Trichloroethylene	520 ^a	4 ^a	7,500 ^a	42 ^a	0.02	0.1	•
108-05-4	Vinyl acetate	1,000,000 ^a	460 ^a	200,000 ^a	34 ^a	84 ^a	84	•
75-01-4	Vinyl chloride	3 ^a	0.003 ^a	43 ^a	0.1 ^a	0.01 ^f	0.05	•
1330-20-7	Xylenes (total)	1,000,000 ^a	320 ^a	1,000,000 ^a	320 ^a	74	74	•
	Ionizable Organics							
65-85-0	Benzoic Acid	1,000,000 ^a	----- ^c	820,000 ^a	----- ^c	280 ^{a,j}	280	•
106-47-8	4 - Chloroaniline (p-Chloroaniline)	8,200 ^a	----- ^c	820 ^a	----- ^c	0.3 ^{a,j}	0.3	1.9
95-57-8	2-Chlorophenol	10,000 ^a	53,000 ^a	10,000 ^a	53,000 ^a	2 ^a	2	•
120-83-2	2,4-Dichlorophenol	6,100 ^a	----- ^c	610 ^a	----- ^c	0.5 ^a	0.5	•

CAS No.	Chemical Name	Route-Specific Values for Surface Soils				Migration to Groundwater Route Values		ADL (mg/kg)
		Industrial-Commercial		Construction Worker		Class I (mg/kg)	Class II (mg/kg)	
		Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)			
105-67-9	2,4-Dimethylphenol	41,000 ^b	----- ^c	41,000 ^b	----- ^c	3 ^{d,j}	3	•
51-28-5	2,4-Dinitrophenol	4,100 ^b	----- ^c	410 ^b	----- ^c	0.1 ^{d,j}	0.1	3.3
95-48-7	2-Methylphenol (o - Cresol)	100,000 ^b	----- ^c	1,000 ^b	----- ^c	6 ^b	6	•
86-30-6	N-Nitrosodiphenylamine	1,200 ^b	----- ^c	17,000 ^b	----- ^c	0.2 ^{d,j}	0.2	0.66
621-64-7	N-Nitrosodi-n-propylamine	0.8 ^b	----- ^c	12 ^b	----- ^c	0.00002 ^{d,j}	0.00002	0.66
87-86-5	Pentachlorophenol	24 ^{d,j}	----- ^c	345 ^{d,j}	----- ^c	0.01 ^{d,j}	0.05	2.4
108-95-2	Phenol	1,000,000 ^b	----- ^c	120,000 ^b	----- ^c	49 ^{d,j}	49	•
95-95-4	2,4,5-Trichlorophenol	200,000 ^b	----- ^c	200,000 ^b	----- ^c	120 ^{d,j}	600	•
88-06-2	2,4,6 Trichlorophenol	520 ^b	320 ^b	7,500 ^b	3,400 ^b	0.06 ^{d,j}	0.06	0.43

		Soil Cleanup Objectives ^a						
		Route-Specific Values for Surface Soils				Migration to Groundwater Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	Class I (mg/L) TCLP	Class II (mg/L) TCLP	
	Inorganics							
7440-36-0	Antimony	820 ^b	----- ^c	82 ^b	----- ^c	0.006 ^{de}	0.024 ^{de}	•
7440-38-2	Arsenic ^{1,2}	3 ^a	230 ^a	46 ^a	1,300 ^a	0.05 ^{de}	0.2 ^{de}	
7440-39-3	Barium	140,000 ^b	500,000 ^b	14,000 ^b	670,000 ^b	2.0 ^{de}	2.0 ^{de}	•
7440-41-7	Beryllium	1 ^a	1,200 ^a	19 ^a	23,000 ^a	0.004 ^{de}	0.5 ^{de}	•
7440-42-8	Boron	180,000 ^b	1,000,000	18,000 ^b	1,000,000	2.0 ^{de}	2.0 ^{de}	•
7440-43-9	Cadmium ^{1,2}	1,000 ^b	1,500 ^b	100 ^b	30,000 ^b	0.005 ^{de}	0.05 ^{de}	•
16887-00-6	Chloride	----- ^c	----- ^c	----- ^c	----- ^c	200 ^{de}	200 ^{de}	•
7440-47-3	Chromium, total	----- ^c	----- ^c	----- ^c	----- ^c	0.1 ^{de}	1.0 ^{de}	•
18540-29-9	Chromium, ion, hexavalent	10,000 ^b	230 ^b	4,100 ^b	4,500 ^b	---	---	•
7440-48-4	Cobalt	120,000 ^b	----- ^c	12,000 ^b	----- ^c	1.0 ^{de}	1.0 ^{de}	•
7440-50-8	Copper ^a	76,000 ^b	----- ^c	7,600 ^b	----- ^c	0.65 ^{de}	0.65 ^{de}	•
57-12-5	Cyanide	41,000 ^b	----- ^c	4,100 ^b	----- ^c	0.2 ^{de}	0.6 ^{de}	•
7782-41-4	Fluoride	120,000 ^b	----- ^c	12,000 ^b	----- ^c	4.0 ^{de}	4.0 ^{de}	•
15438-31-0	Iron	----- ^c	----- ^c	----- ^c	----- ^c	5.0 ^{de}	5.0 ^{de}	•

Soil Cleanup Objectives ^a								
		Route-Specific Values for Surface Soils				Migration to Groundwater Route ¹ Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	Class I (mg/L) TCLP	Class II (mg/L) TCLP	
7439-92-1	Lead	400 ^b	----- ^c	400 ^b	----- ^c	0.0075 ^m	0.1 ⁿ	•
7439-96-5	Manganese	100,000 ^b	50,000 ^b	10,000 ^b	6,700 ^b	0.15 ^m	10.0 ⁿ	•
7439-97-6	Mercury ^{1*}	610 ^b	300,000 ^b	61 ^b	40,000 ^b	0.002 ^m	0.01 ⁿ	•
7440-02-0	Nickel ¹	41,000 ^b	12,000 ^b	4,100 ^b	230,000 ^b	0.1 ^m	2.0 ⁿ	•
14797-55-8	Nitrate as N ²	1,000,000 ^b	----- ^c	330,000 ^b	----- ^c	10.0 ^m	100 ⁿ	•
7782-49-2	Selenium ^{1*}	10,000 ^b	----- ^c	1,000 ^b	----- ^c	0.05 ^m	0.05 ⁿ	•
7440-22-4	Silver	10,000 ^b	----- ^c	1,000 ^b	----- ^c	0.05 ^m	---	•
14808-79-8	Sulfate	----- ^c	----- ^c	----- ^c	----- ^c	400 ^m	400 ⁿ	•
7440-28-0	Thallium	160 ^b	----- ^c	160 ^b	----- ^c	0.002 ^m	0.02 ⁿ	•
7440-62-2	Vanadium ¹	14,000 ^b	----- ^c	1,400 ^b	----- ^c	0.049 ^m	---	•
7440-66-6	Zinc ¹	610,000 ^b	----- ^c	61,000 ^b	----- ^c	5.0 ^m	10 ⁿ	•

*** indicates that the ADL is less than or equal to the specified cleanup objective

NA means Not Available; no PQL or EQL available in USEPA analytical methods.

Chemical Name and Soil Cleanup Objective Notations (2nd, 5th thru 8th Columns)

- Soil remediation objectives based on human health criteria only.
- Calculated values correspond to a target hazard quotient of 1
- No toxicity criteria available for this route of exposure.
- Soil saturation concentration (C_{sat}) = the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached. Above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required.
- Calculated values correspond to a cancer risk level of 1 in 1,000,000. Site-specific conditions may warrant use of a greater risk level but not to exceed 1 in 10,000.
- Level is at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).
- Chemical-specific properties are such that this route is not of concern at any soil contaminant concentration.
- A preliminary goal of 1 ppm has been set for PCBs based on *Guidance on Remedial Actions for Superfund Sites with PCB Contamination*, EPA/540G-90/007, and on USEPA efforts to manage PCB contamination. See 40 CFR 761.120 for USEPA "PCB Spill Cleanup Policy." This regulation goes on to say that the cleanup goal for an unrestricted area is 10 ppm and 25 ppm for a restricted area, provided both have at least 10 inches of clean cover.
- Soil remediation objective for pH of 6.8. If soil pH is other than 6.8, refer to Appendix B, Tables C and D.
- Ingestion soil remediation objective adjusted by a factor of 0.5 to account for dermal route.
- A preliminary remediation goal of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER Directive #9355.4-12.
- Potential for soil-plant-human exposure.
- Concentration in mg/L determined by the Toxicity Characteristic Leaching Procedure (TCLP). The person conducting the remediation has the option to use TCLP objectives listed in this Table or the applicable pH-specific soil cleanup objective in Appendix B, Table C and D. If the person wishes to calculate cleanup objectives based on background concentrations, this should be done in accordance with Subpart C of Part 742.
- The Agency reserves the right to evaluate the potential for remaining contaminant concentrations to pose significant threats to crops, livestock, or wildlife.
- For agricultural facilities, cleanup objectives for surficial soils which are based on field application rates may be more appropriate for currently registered pesticides. Consult the Agency for further information.
- For agricultural facilities, soil cleanup objectives based on site-specific background concentrations of Nitrate as N may be more appropriate. Such determinations shall be conducted in accordance with the Tier 3 evaluation procedures set forth in Subpart H of Part 742.
- For cyanide, the TCLP extraction must be done using water at a pH of 7.0.

Section 742.APPENDIX B: Tier 1 Tables and Illustrations

Table C: pH Specific Soil Cleanup Objectives for Inorganics and Ionizing Organics for Protection of Class I Groundwater

Chemical (totals) (mg/kg)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Inorganics									
Arsenic	12	13	13	14	15	15	15	16	16
Barium	12	16	19	21	26	32	35	87	340
Beryllium	0.06	0.15	0.75	6	50	142	429	2,830	17,870
Cadmium	0.04	0.06	0.10	0.30	2	6	13	63	230
Chromium (+6)	36	31	27	24	20	19	18	16	14
Copper	165	367	1,030	5,790	30,400	65,000	100,700	163,300	163,300
Mercury	0.004	0.008	0.025	0.15	1	3	3	4	4
Nickel	0.9	1	2	3	11	20	32	71	115
Selenium	12	9	6	4	3	3	2	2	1
Thallium	0.20	0.20	0.30	0.30	0.30	0.30	0.40	0.40	0.50
Zinc	73	101	209	899	6,305	17,750	47,760	250,600	792,500

Chemical (totals) (mg/kg)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Organics									
Benzoic Acid	63	59	57	57	56	56	56	56	56
2,4-Dichlorophenol	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.09	0.07
Pentachlorophenol	0.25	0.20	0.06	0.03	0.02	0.01	0.01	0.01	0.01
2,4,5- Trichlorophenol	35	35	34	33	26	22	17	9	5
2,4,6- Trichlorophenol	0.16	0.14	0.12	0.10	0.06	0.05	0.04	0.03	0.01

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Table D: pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics for Protection of Class II Groundwater

Chemical (totals) (mg/kg)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Inorganics									
Arsenic	48	52	52	56	60	60	60	64	64
Barium	12	16	19	21	26	32	35	87	340
Beryllium	7.5	19	94	750	6,250	17,750	53,625	353,750	1,000,000
Cadmium	0.4	0.6	1	3	20	60	130	630	2,300
Chromium (+6)	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Copper	165	367	1,030	5,790	30,400	65,000	100,700	163,300	163,300
Mercury	0.02	0.04	0.12	0.75	5	15	15	20	20
Nickel	18	20	40	60	220	400	640	1,420	2,300
Selenium	12	9	6	4	3	3	2	2	1
Thallium	2	2	3	3	3	3	4	4	5
Zinc	146	202	418	1,798	12,610	35,500	95,520	501,200	1,000,000

Chemical (totals) (mg/kg)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Organics									
Benzoic Acid	63	59	57	57	56	56	56	56	56
2,4-Dichlorophenol	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.09	0.07
Pentachlorophenol	1.2	1.0	0.30	0.15	0.1	0.05	0.05	0.05	0.05
2,4,5- Trichlorophenol	175	175	170	165	130	110	85	45	25
2,4,6- Trichlorophenol	0.16	0.14	0.12	0.10	0.06	0.05	0.04	0.03	0.01

Section 742.APPENDIX B: Tier 1 Tables and Illustrations

TABLE E: Tier 1 Groundwater Cleanup Objectives

CAS No.	Chemical Name	Groundwater Cleanup Objective	
		Class I Baseline (mg/L)	Class II Baseline (mg/L)
83-32-9	Acenaphthene	0.42	2.1
67-64-1	Acetone	0.7	0.7
15972-60-8	Alachlor ^o	0.002 ³	0.01 ³
116-06-3	Aldicarb ^o	0.003 ³	0.015 ³
309-00-2	Aldrin	0.00004 ¹	0.0002
120-12-7	Anthracene	2.1	10.5
1912-24-9	Atrazine ^o	0.003 ³	0.015 ³
71-43-2	Benzene	0.005 ³	0.025 ³
56-55-3	Benzo(a)anthracene	0.00013 ¹	0.00065
205-99-2	Benzo(b)fluoranthene	0.00018 ¹	0.0009
207-08-9	Benzo(k)fluroanthene	0.00017 ¹	0.00085
50-32-8	Benzo(a)pyrene	0.0002 ^{1,3}	0.002 ³
111-44-4	Bis(2-chloroethyl)ether	0.01 ¹	0.01
117-81-7	Bis(2-ethylhexyl)phthalate	0.006 ^{1,3}	0.06 ³
75-27-4	Bromodichloromethane (Dichlorobromomethane)	0.00002 ¹	0.0001
75-25-2	Bromoform	0.0002 ¹	0.0002
71-36-3	Butanol	0.7	0.7
85-68-7	Butyl benzyl phthalate	1.4	7.0
86-74-8	Carbazole	—	—
1563-66-2	Carbofuran ^o	0.04 ³	0.2 ³
75-15-0	Carbon disulfide	0.7	3.5
56-23-5	Carbon tetrachloride	0.005 ³	0.025 ³

		Groundwater Cleanup Objective	
CAS No.	Chemical Name	Class I Baseline (mg/L)	Class II Baseline (mg/L)
57-74-9	Chlordane	0.002 ³	0.01 ³
108-90-7	Chlorobenzene (Monochlorobenzene)	0.1 ³	0.5 ³
124-48-1	Chlorodibromomethane (Dibromochloromethane)	0.14	0.14
67-66-3	Chloroform	0.00002 ¹	0.0001
218-01-9	Chrysene	0.0015 ¹	0.0075
94-75-7	2,4-D	0.07 ³	0.35 ³
75-99-0	Dalapon	0.2 ³	2.0 ³
72-54-8	DDD	0.00011 ¹	0.00055
72-55-9	DDE	0.00004 ¹	0.0002
50-29-3	DDT	0.00012 ¹	0.0006
53-70-3	Dibenzo(a,h)anthracene	0.0003 ¹	0.0015
96-12-8	1,2-Dibromo-3-chloropropane	0.0002 ³	0.0002 ³
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	0.00005 ^{1,3}	0.0005 ³
84-74-2	Di-n-butyl phthalate	0.7	3.5
95-50-1	1,2-Dichlorobenzene (o - Dichlorobenzene)	0.6 ³	1.5 ³
106-46-7	1,4-Dichlorobenzene (p - Dichlorobenzene)	0.075 ³	0.375 ³
91-94-1	3,3'-Dichlorobenzidine	0.02 ¹	0.1
75-34-3	1,1-Dichloroethane	0.7	3.5
107-06-2	1,2-Dichloroethane (Ethylene dichloride)	0.005 ³	0.025 ³
75-35-4	1,1-Dichloroethylene ²	0.007 ³	0.035 ³
156-59-2	cis-1,2-Dichloroethylene	0.07 ³	0.2 ³
156-60-5	trans-1,2-Dichloroethylene	0.1 ³	0.5 ³

		Groundwater Cleanup Objective	
CAS No.	Chemical Name	Class I Baseline (mg/L)	Class II Baseline (mg/L)
78-97-5	1,2-Dichloropropane	0.005 ³	0.025 ³
542-75-6	1,3-Dichloropropene (1,3-Dichloropropylene, <i>cis</i> + <i>trans</i>)	0.001 ¹	0.005
60-57-1	Dieldrin ^a	0.00002 ¹	0.0001
84-66-2	Diethyl phthalate	5.6	5.6
131-11-3	Dimethyl phthalate ²	7.0	7.0
121-14-2	2,4-Dinitrotoluene	0.014	0.014
606-20-2	2,6-Dinitrotoluene ²	0.007	0.007
88-85-7	Dinoseb ^a	0.007 ³	0.07 ³
117-84-0	Di- <i>n</i> -octyl phthalate	0.14	0.7
115-29-7	Endosulfan	0.042	0.042
145-73-3	Endothall ^a	0.1 ³	0.1 ³
72-20-8	Endrin	0.002 ³	0.01 ³
100-41-4	Ethylbenzene	0.7 ³	1.0 ³
206-44-0	Fluoranthene	0.28	1.4
86-73-7	Fluorene	0.28	1.4
76-44-8	Heptachlor	0.0004 ³	0.002 ³
1024-57-3	Heptachlor epoxide	0.0002 ³	0.001 ³
118-74-1	Hexachlorobenzene	0.00006 ¹	0.0003
319-84-6	<i>alpha</i> -HCH (<i>alpha</i> -BHC)	0.00003 ¹	0.00015
58-89-9	<i>gamma</i> -HCH (Lindane) ^a	0.0002 ³	0.001 ³
77-47-4	Hexachlorocyclopentadiene	0.05 ³	0.5 ³
67-72-1	Hexachloroethane	0.007	0.007
193-39-5	Indeno(1,2,3- <i>c,d</i>)pyrene	0.00043 ¹	0.00215
78-59-1	Isonorbornene	1.4	1.4

		Groundwater Cleanup Objective	
CAS No.	Chemical Name	Class I Baseline (mg/L)	Class II Baseline (mg/L)
72-43-5	Methoxychlor	0.04 ³	0.2 ³
74-83-9	Methyl bromide (Bromomethane)	0.0098	0.0098
75-09-2	Methylene chloride (Dichloromethane)	0.005 ³	0.05 ³
91-20-3	Naphthalene ²	0.025	0.039
98-95-3	Nitrobenzene ²	0.0035	0.0035
1918-02-1	Picloram ^o	0.5 ³	5.0 ³
1336-36-3	Polychlorinated biphenyls (PCBs) ^a	0.0005 ³	0.0025 ³
129-00-0	Pyrene	0.21	1.05
122-34-9	Simazine ^o	0.004 ³	0.04 ³
100-42-5	Styrene	0.1 ³	0.5 ³
93-72-1	2,4,5-TP (Silvex)	0.05 ³	0.25 ³
127-18-4	Tetrachloroethylene (Perchloroethylene)	0.005 ³	0.025 ³
108-88-3	Toluene	1.0 ³	2.5 ³
8001-35-2	Toxaphene ^o	0.003 ³	0.015 ³
120-82-1	1,2,4-Trichlorobenzene	0.07 ³	0.7 ³
71-55-6	1,1,1-Trichloroethane ²	0.2 ³	1.0 ³
79-00-5	1,1,2-Trichloroethane	0.005 ³	0.05 ³
79-01-6	Trichloroethylene	0.005 ³	0.025 ³
108-05-4	Vinyl acetate	7.0	7.0
75-01-4	Vinyl chloride	0.002 ³	0.01 ³
1330-20-7	Xylenes (total)	10.0 ³	10.0 ³
	Ionizable Organics		

		Groundwater Cleanup Objective	
CAS No.	Chemical Name	Class I Baseline (mg/L)	Class II Baseline (mg/L)
65-85-0	Benzoic Acid	28	28
106-47-8	4-Chloroaniline (<i>p</i> -Chloroaniline)	0.028	0.028
95-57-8	2-Chlorophenol	0.035	0.035
120-83-2	2,4-Dichlorophenol	0.021	0.021
105-67-9	2,4-Dimethylphenol	0.14	0.14
51-28-5	2,4-Dinitrophenol	0.014	0.014
95-48-7	2-Methylphenol (<i>o</i> - Cresol)	0.35	0.35
86-30-6	<i>N</i> -Nitrosodiphenylamine	0.01 ¹	0.01
621-64-7	<i>N</i> -Nitrosodi- <i>n</i> -propylamine	0.01 ¹	0.01
87-86-5	Pentachlorophenol	0.001 ^{1,3}	0.005 ³
108-95-2	Phenol	0.1 ³	0.1 ³
95-95-4	2,4,5-Trichlorophenol	0.7	3.5
88-06-2	2,4,6 Trichlorophenol	0.0064 ¹	0.0064

		Groundwater Cleanup Objective	
CAS No.	Chemical Name	Class I Baseline (mg/L)	Class II Baseline (mg/L)
	Inorganics		
7440-36-0	Antimony	0.006 ³	0.024 ³
7440-38-2	Arsenic ^{1,a}	0.05 ³	0.2 ³
7440-39-3	Barium	2.0 ³	2.0 ³
7440-41-7	Beryllium	0.004 ³	0.5 ³
7440-42-8	Boron	2.0 ³	2.0 ³
7440-43-9	Cadmium ^{1,a}	0.005 ³	0.05 ³
16887-00-6	Chloride	200 ³	200 ³
7440-47-3	Chromium, total	0.1 ³	1.0 ³
18540-29-9	Chromium, ion, hexavalent	—	—
7440-48-4	Cobalt	1.0 ³	1.0 ³
7440-50-8	Copper ^a	0.65 ³	0.65 ³
57-12-5	Cyanide	0.2 ³	0.6 ³
7782-41-4	Fluoride	4.0 ³	4.0 ³
15438-31-0	Iron	5.0 ³	5.0 ³
7439-92-1	Lead	0.0075 ³	0.1 ³
7439-96-5	Manganese	0.15 ³	10.0 ³
7439-97-6	Mercury ^{1,a}	0.002 ³	0.01 ³
7440-02-0	Nickel ¹	0.1 ³	2.0 ³
14797-55-8	Nitrate as N ^p	10.0 ³	100 ³
7782-49-2	Selenium ^{1,a}	0.05 ³	0.05 ³
7440-22-4	Silver	0.05 ³	—
14808-79-8	Sulfate	400 ³	400 ³
7440-28-0	Thallium	0.002 ³	0.02 ³
7440-62-2	Vanadium ²	0.049	—

		Groundwater Cleanup Objective	
CAS No.	Chemical Name	Class I Baseline (mg/L)	Class II Baseline (mg/L)
7440-66-6	Zinc ¹	5.0 ³	10 ³

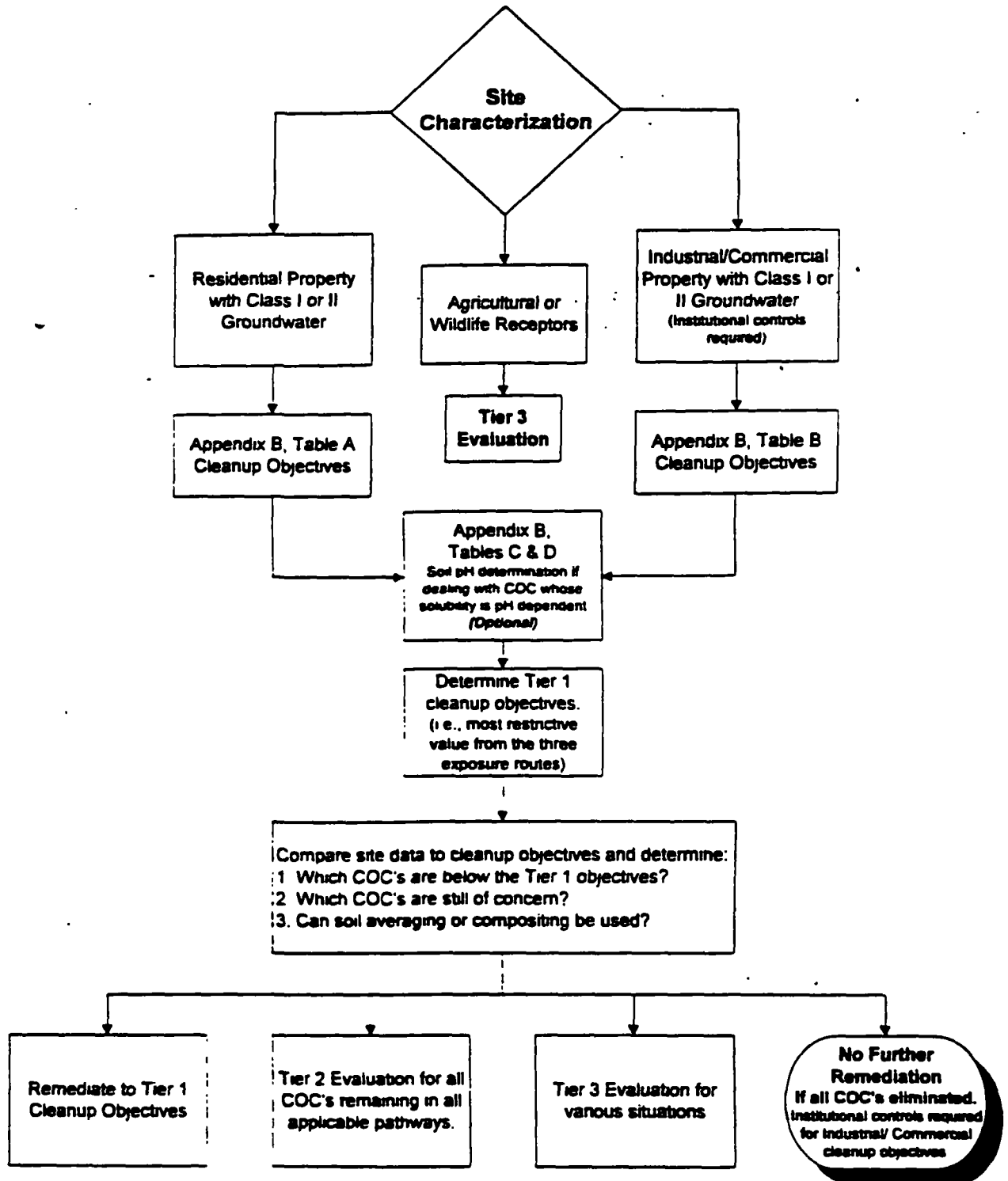
Chemical Name and Groundwater Cleanup Objective Notations

- ¹ Acceptable Detection Limit - The groundwater Health Advisory concentration is equal to ADL for carcinogens as specified in 35 Ill. Adm. Code 620, Subpart F. "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods," EPA Publication No. SW-846 and "Methods for the Determination of Organic Compounds in Drinking Water," EPA, EMSL, EPA-600/4-88/039 must be used.
- ² Oral Reference Dose and/or Reference Concentration under review by USEPA. Listed values subject to change.
- ³ Value listed is also the Groundwater Quality Standard for this chemical pursuant to 35 Ill. Adm. Code 620.410 for Class I Groundwater or 35 Ill. Adm. Code 620.420 for Class II Groundwater.
- ⁴ Considered a volatile chemical for purposes of Part 742.

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Illustration A:

Tier 1 Evaluation



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Section 742.APPENDIX C: Tier 2 Tables and Illustrations

Table A: SSL Equations

Equations for Ingestion of Contaminants in Soil	Cleanup Objectives for Noncarcinogenic Contaminants (mg/kg)*	$\frac{THQ \cdot BW \cdot AT \cdot 365 \frac{d}{yr}}{\frac{1}{RID_0} \cdot 10^{-6} \frac{kg}{mg} \cdot EF \cdot ED \cdot IR_{soil}}$	S1
	Cleanup Objectives for Carcinogenic Contaminants, Residential (mg/kg)	$\frac{TR \cdot AT_c \cdot 365 \frac{d}{yr}}{SF_0 \cdot 10^{-6} \frac{kg}{mg} \cdot EF \cdot IF_{soil-adj}}$	S2
	Cleanup Objectives for Carcinogenic Contaminants - Industrial/Commercial, Construction Worker (mg/kg)	$\frac{TR \cdot BW \cdot AT_c \cdot 365 \frac{d}{yr}}{SF_0 \cdot 10^{-6} \frac{kg}{mg} \cdot EF \cdot ED \cdot IR_{soil}}$	S3

Equation for Inhalation of Contaminants in Soil	Residential, Industrial-Commercial Cleanup Objectives for Noncarcinogenic Contaminants (mg/kg) ^a	$\frac{THQ \cdot AT \cdot 365 \frac{d}{yr}}{EF \cdot ED \cdot \frac{1}{RfC} \cdot \left(\frac{1}{VF'} + \frac{1}{PEF'} \right)}$	S4
	Construction Worker Cleanup Objectives for Noncarcinogenic Contaminants (mg/kg) ^a	$\frac{THQ \cdot AT \cdot 365 \frac{d}{yr}}{EF \cdot ED \cdot \frac{1}{RfC} \cdot \left(\frac{1}{VF'} + \frac{1}{PEF'} \right)}$	S5
	Residential, Industrial-Commercial Cleanup Objectives for Carcinogenic Contaminants (mg/kg)	$\frac{TR \cdot AT_c \cdot 365 \frac{d}{yr}}{URF \cdot 1,000 \frac{\mu g}{mg} \cdot EF \cdot ED \cdot \left(\frac{1}{VF} + \frac{1}{PEF} \right)}$	S6

	Construction Worker Cleanup Objectives for Carcinogenic Contaminants (mg/kg) ^a	$\frac{TR \cdot AT_c \cdot 365 \frac{d}{yr}}{URF \cdot 1,000 \frac{\mu g}{mg} \cdot EF \cdot ED \cdot \left(\frac{1}{VF'} + \frac{1}{PEF'} \right)}$	S7
	Equation for Derivation of the Volatization Factor for Residential, Industrial-Commercial, VF (m ³ /kg)	$VF = \frac{Q}{C_{VF}} \cdot \frac{(3.14 \cdot \alpha \cdot T)^{\frac{1}{2}}}{(2 \cdot D_{al} \cdot \theta_s \cdot K_{as})} \cdot 10^{-4} \frac{m^2}{cm^2}$	S8
	Equation for Derivation of the Volatization Factor for Construction Worker, VF' (m ³ /kg)	$VF' = \frac{VF}{10}$	S9
	Equation for Derivation of α (cm ² /s)	$\alpha = \frac{D_{al} \cdot \theta_s}{\theta_s + \frac{(\rho_s)(1 - \theta_s)}{K_{as}}}$	S10

Partition Equation for Migration to Groundwater	Remediation Objective (mg/kg)	$C_w = \left[K_d + \frac{(\theta_w + \theta_s \cdot H')}{\rho_b} \right]$	S11
	Dilution Factor, DF	$DF = 1 + \frac{K \cdot I \cdot d}{I \cdot L}$	S12
Equation for Derivation of the Soil Saturation Limit, C_{sat}		$C_{sat} = \frac{S}{\rho_b} \cdot [(K_d \cdot \rho_b) + \theta_w + (H' \cdot \theta_s)]$	S13
Equation for Estimation of Mixing Zone Depth, d (m)	d =	$(0.0112 \cdot L^2)^{0.5} + d_s \left[1 - \exp \frac{(-L \cdot I)}{(K \cdot I \cdot d_s)} \right]$	S14
Target Soil Leachate Concentration, C_w (mg/L)		$C_w = DF \cdot GW_{obj}$	S15

Effective Diffusivity, D_e (cm ² /s)	$D_e = D_i \left(\frac{\theta_e^{3.33}}{\eta^2} \right)$	S16
Soil-Air Partition Coefficient, K_{sa} (g _{soil} /cm ³ _{air})	$K_{sa} = \frac{H'}{K_d}$	S17
Soil-Water Partition Coefficient, K_d (cm ³ /g)	$K_d = K_{oc} \cdot f_{oc}$	S18
Air-Filled Soil Porosity, θ_a (L _{air} /L _{soil})	$\theta_a = \eta - \frac{(w \cdot \rho_b)}{\rho_w}$	S19
Water-Filled Soil Porosity, θ_w (L _{water} /L _{soil})	$\theta_w = \frac{w \cdot \rho_b}{\rho_w}$	S20

Total Soil Porosity, η ($L_{\text{pore}}/L_{\text{total}}$)	$\eta = 1 - \frac{\rho_b}{\rho_s}$	S21
Groundwater Cleanup Objective for Carcinogenic Contaminants for Residential, Industrial-Commercial, GW_{adj} (mg/L)	$\frac{TR \cdot 70 \text{ kg} \cdot AT_c \cdot 365 \frac{d}{yr}}{SF_o \cdot 2 \frac{L}{d} \cdot 350 \frac{d}{yr} \cdot 30 \text{ yr}}$	S22

Section 742.APPENDIX C: Tier 2 Tables and Illustrations

Table B: SSL Parameters

Symbol	Parameter	Units	Source	Parameter Value(s)
AT	Averaging Time for Noncarcinogens in Ingestion Equation	yr	SSL	Residential = 6 Industrial/Commercial = 25 Construction Worker = 0.173
AT	Averaging Time for Noncarcinogens in Inhalation Equation	yr	SSL	Residential = 30 Industrial/Commercial = 25 Construction Worker = 0.173
AT _c	Averaging Time for Carcinogens	yr	SSL	70
BW	Body Weight	kg	SSL	Residential = 15 Industrial/Commercial = 70 Construction Worker = 70
C _{ss}	Soil Saturation Concentration	mg/kg	Appendix A, Table A or Equation S13 in Appendix C, Table A	Chemical-Specific or Calculated Value
C _w	Target Soil Leachate Concentration	mg/L	Equation S15 in Appendix C, Table A	Groundwater Standard, Health Advisory, or Calculated Value
d	Mixing Zone Depth	m	SSL or Equation S14 in Appendix C, Table A	2 m or Calculated Value
d _a	Aquifer Thickness	m	Field Measurement	Site-Specific
D _d	Effective Diffusivity	cm ² /s	Equation S16 in Appendix C, Table A	Calculated Value
D _i	Diffusivity in Air	cm ² /s	Appendix C, Table E	Chemical-Specific

Symbol	Parameter	Units	Source	Parameter Value(s)
DF	Dilution Factor	unitless	Equation S12 in Appendix C, Table A	10 or Calculated Value
ED	Exposure Duration for Ingestion of Carcinogens	yr	SSL	Industrial/Commercial = 25 Construction Worker = 1
ED	Exposure Duration for Inhalation of Carcinogens	yr	SSL	Residential = 30 Industrial/Commercial = 25 Construction Worker = 1
ED	Exposure Duration for Ingestion of Noncarcinogens	yr	SSL	Residential = 6 Industrial/Commercial = 25 Construction Worker = 1
ED	Exposure Duration for Inhalation of Noncarcinogens	yr	SSL	Residential = 30 Industrial/Commercial = 25 Construction Worker = 1
EF	Exposure Frequency	d/yr	SSL	Residential = 350 Industrial/Commercial = 250 Construction Worker = 45
F(x)	Function dependent on U_m/U_t	unitless	SSL	0.194
f_{oc}	Organic Carbon Content of Soil	g/g	SSL or Field Measurement (See Appendix C, Table F)	Surface Soil = 0.006 Subsurface soil = 0.002, or Site-Specific
GW _{obj}	Groundwater Cleanup Objective	mg/L	Equation S22 in Appendix C, Table A	Calculated
H'	Henry's Law Constant	unitless	Appendix C, Table E	Chemical-Specific
i	Hydraulic Gradient	m/m	Field Measurement (See Appendix C, Table F)	Site-Specific

Symbol	Parameter	Units	Source	Parameter Value(s)
I	Infiltration Rate	m/yr	SSL	0.3
IF _{soil-adj} (residential)	Age Adjusted Soil Ingestion Factor for Carcinogens	(mg-yr)/(kg-d)	SSL	Residential = 114
IR _{soil}	Soil Ingestion Rate for Noncarcinogens	mg/d	SSL	Residential = 200 Industrial/Commercial = 50 Construction Worker = 480
K	Aquifer Hydraulic Conductivity	m/yr	Field Measurement (See Appendix C, Table F)	Site-Specific
K _{sa}	Soil-Air Partition Coefficient	g _{soil} /cm ³ _{air}	Equation S17 in Appendix C, Table A	Calculated Value
K _d	Soil-Water Partition Coefficient	cm ³ /g or L/kg	Equation S18 in Appendix C, Table A	Calculated Value
K _{oc}	Organic Carbon Partition Coefficient	cm ³ /g or L/kg	Appendix C, Table E	Chemical-Specific
L	Source Length Parallel to Groundwater Flow	m	Field Measurement	Site-Specific
PEF	Particulate Emission 10 ⁻⁴ to 10 ⁻⁴ Factor	m ³ /kg	SSL	6.79 • 10 ⁶
PEF'	Particulate Emission Factor adjusted for Agitation (construction worker)	m ³ /kg	SSL	9.53 • 10 ⁷
Q/C _{vr} (Equation S8 in Table F)	Inverse of the mean concentration at the center of a 30 acre square source (used in VF equation)	(g/m ³ -s)/(kg/m ³)	SSL	Residential = 35.10 Industrial/Commercial = 35.10 Construction Worker = 65.75

Symbol	Parameter	Units	Source	Parameter Value(s)
RfC	Inhalation Reference Concentration	mg/m ³	IEPA (IRIS/HEAST)	Toxicological-Specific
RfD _o	Oral Reference Dose	mg/(kg-d)	IEPA (IRIS/HEAST)	Toxicological-Specific (Note: for Construction Worker use subchronic reference doses)
S	Solubility in Water	mg/L	Appendix C, Table E	Chemical-Specific
SF _o	Oral Slope Factor	(mg/kg-d) ⁻¹	IEPA (IRIS/HEAST)	Toxicological-Specific
T	Exposure Interval	s	SSL	Residential = $9.5 \cdot 10^3$ Industrial/Commercial = $7.9 \cdot 10^3$ Construction Worker = $1.3 \cdot 10^4$
THQ	Target Hazard Quotient	unitless	SSL	1
TR	Target Cancer Risk	unitless	SSL	Residential = 10^{-4} to 10^{-4} Industrial/Commercial = 10^{-4} to 10^{-4} Construction Worker = 10^{-4} to 10^{-4}
U _m	Mean Annual Windspeed	m/s	SSL	4.69
URF	Inhalation Unit Risk Factor	(ug/m ³) ⁻¹	IEPA (IRIS/HEAST)	Toxicological-Specific
U _i	Equivalent Threshold Value of Windspeed at 2 m	m/s	SSL	11.32
V	Fraction of Vegetative Cover	unitless	SSL	0.5
VF	Volatization Factor	m ³ /kg	Equation S8 in Appendix C, Table A	Calculated Value
VF'	Volatization Factor adjusted for Agitation	m ³ /kg	Equation S9 in Appendix C, Table A	Calculated Value

Symbol	Parameter	Units	Source	Parameter Value(s)
w	Average Soil Moisture Content	$\theta_{water}/\theta_{soil}$	SSL or Field Measurement (See Appendix C, Table F)	0.1, or Surface Soil (top 1 meter) = 0.1 Subsurface Soil (below 1 meter) = 0.2, or Site-Specific
α	Dispersivity Factor	cm^2/s	Equation S10 in Appendix C, Table A	Calculated Value
η	Total Soil Porosity	L_{pore}/L_{soil}	SSL or Equation S21 in Appendix C, Table A	0.43, or Gravel = 0.25 Sand = 0.32 Silt = 0.40 Clay = 0.36, or Calculated Value
θ_a	Air-Filled Soil Porosity	L_{air}/L_{soil}	SSL or Equation S19 in Appendix C, Table A	Surface Soil (top 1 meter) = 0.28 Subsurface Soil (below 1 meter) = 0.13, or Gravel = 0.05 Sand = 0.14 Silt = 0.24 Clay = 0.19, or Calculated Value

Symbol	Parameter	Units	Source	Parameter Value(s)
θ_w	Water-Filled Soil Porosity	$L_{\text{water}}/L_{\text{soil}}$	SSL or Equation S20 in Appendix C, Table A	Surface Soil (top 1 meter) = 0.15 Subsurface Soil (below 1 meter) = 0.30, or Gravel = 0.20 Sand = 0.18 Silt = 0.16 Clay = 0.17, or Calculated Value
ρ_b	Dry Soil Bulk Density	kg/L	SSL or Field Measurement (See Appendix C, Table F)	1.5, or Gravel = 2.0 Sand = 1.8 Silt = 1.6 Clay = 1.7, or Site-Specific
ρ_s	Soil Particle Density	g/cm ³	SSL or Field Measurement (See Appendix C, Table F)	2.65, or Surface Soil (top 1 meter) = 2.63 Subsurface Soil (below 1 meter) = 2.65, or Site-Specific
ρ_w	Water Density	g/cm ³	SSL	1

Section 742. Appendix C:

Tier 2 Tables and Illustrations

Table C: RBCA Equations

Ingestion of Soil, Inhalation of Vapors and Particulates, and Dermal Contact	Cleanup Objectives for Carcinogenic Contaminants (mg/kg)	$\frac{TR \cdot BW \cdot AT_c \cdot 365 \frac{d}{yr}}{EF \cdot ED \left\{ [SF_o \cdot 10^{-6} \frac{kg}{mg} \cdot ((IR_{soil} \cdot RAF_o) + (SA \cdot M \cdot RAF_o))] + [SF_i \cdot IR_{air} \cdot (VF_{so} + VF_p)] \right\}}$	R1
	Cleanup Objectives for Noncarcinogenic Contaminants (mg/kg)	$\frac{THQ \cdot BW \cdot AT_n \cdot 365 \frac{d}{yr}}{EF \cdot ED \cdot \left[\frac{10^{-6} \frac{kg}{mg} [(IR_{soil} \cdot RAF_o) + (SA \cdot M \cdot RAF_o)]}{RID_o} + \frac{(IR_{air} (VF_{so} + VF_p))}{RID_i} \right]}$	R2
	Volatization Factor for Surficial Soils, VF_{so} (kg/m ³) Whichever is less between R3 and R4	$VF_{so} = \frac{2 \cdot W \cdot \rho_s \cdot 10^3 \frac{cm^3 \cdot kg}{m^3 \cdot g}}{U_{air} \cdot \delta_{air}} \cdot \sqrt{\frac{D_i^{eff} \cdot H'}{\pi \cdot [\theta_{so} + (k_s \cdot \rho_s) + (H' \cdot \theta_{so})] \cdot \tau}}$	R3

		$VF_{ss} = \frac{W \cdot \rho_s \cdot d \cdot 10^3 \frac{\text{cm}^3 \text{ kg}}{\text{m}^3 \text{ g}}}{U_{air} \cdot \delta_{air} \cdot T}$	R4
	Volatization Factor for Surficial Soils Regarding Particulates, VF_p , (kg/m ³)	$VF_p = \frac{P_s \cdot W \cdot 10^3 \frac{\text{cm}^3 \text{ kg}}{\text{m}^3 \text{ g}}}{U_{air} \cdot \delta_{air}}$	R5
	Effective Diffusion Coefficient in Soil Based on Vapor-Phase Concentration, D_s^{eff} (cm ² /s)	$D_s^{eff} = \frac{D_{air} \cdot \theta_{ss}^{3.33}}{\theta_T^2} + \frac{D_{water} \cdot \theta_{ws}^{3.33}}{H' \cdot \theta_T^2}$	R6
Ambient Vapor Inhalation (outdoor)	Cleanup Objectives for Carcinogenic Contaminants (mg/kg)	$\frac{RBSL_{air} \cdot 10^{-3}}{VF_{amb}}$	R7

Cleanup Objectives for Noncarcinogenic Contaminants (mg/kg)	$\frac{RBSL_{air} \cdot 10^{-3}}{VF_{soil}}$	R8
Carcinogenic Risk-Based Screening Level for Air, $RBSL_{air}$ (ug/m ³)	$RBSL_{air} = \frac{TR \cdot BW \cdot AT_c \cdot 365 \frac{d}{yr} \cdot 10^3 \frac{ug}{mg}}{SF_1 \cdot IR_{air} \cdot EF \cdot ED}$	R9
Noncarcinogenic Risk-Based Screening Level for Air, $RBSL_{air}$ (ug/m ³)	$RBSL_{air} = \frac{THQ \cdot RfD_1 \cdot BW \cdot AT_n \cdot 365 \frac{d}{yr} \cdot 10^3 \frac{ug}{mg}}{IR_{air} \cdot EF \cdot ED}$	R10
Volatization Factor - Subsurface Soil to Ambient Air, VF_{soil} (mg/m ³)/(mg/kg _{soil})	$VF_{soil} = \frac{H' \cdot \rho_s \cdot 10^3 \frac{cm^3}{m^3} \frac{kg}{g}}{[\theta_{ws} + (k_s \cdot \rho_s) + (H' \cdot \theta_{as})] \left[1 + \frac{(U_{air} \cdot \delta_{air} \cdot L_s)}{(D_s^{eff} \cdot W)} \right]}$	R11

Leaching to Groundwater	Cleanup Objective (mg/kg)	$\frac{GW_{source}}{LF_{gw}}$	R12
	Groundwater at the source, GW_{source} (mg/L)	$GW_{source} \frac{GW_{comp}}{C_{(x)} / C_{source}}$	R13
	Leaching Factor, LF_{gw} (mg/L _{source})/(mg/kg _{soil})	$LF_{gw} = \frac{\rho_s \cdot \frac{cm^3 \cdot kg}{L \cdot g}}{[\theta_{ws} + (k_s \cdot \rho_s) + (H' \cdot \theta_{ss})] \left[1 + \frac{(U_{gw} \cdot \delta_{gw})}{(I \cdot W)} \right]}$	R14

Steady-State Attenuation Along the Centerline of a Dissolved Plume, $C_{(x)}/C_{\text{source}}$	$C_{(x)}/C_{\text{source}} = \exp \left[\left(\frac{X}{2\alpha_x} \right) \cdot \left(1 - \sqrt{1 + \frac{4\lambda \cdot \alpha_x}{U}} \right) \right] \cdot \operatorname{erf} \left[\frac{S_w}{4 \cdot \sqrt{\alpha_y \cdot X}} \right] \cdot \operatorname{erf} \left[\frac{S_d}{4 \cdot \sqrt{\alpha_z \cdot X}} \right]$	R15
Longitudinal Dispersivity, α_x (cm)	$\alpha_x = 0.10 \cdot X$	R16
Transverse Dispersivity, α_y (cm)	$\alpha_y = \frac{\alpha_x}{3}$	R17
Vertical Dispersivity, α_z (cm)	$\alpha_z = \frac{\alpha_x}{20}$	R18

Specific Discharge, U (cm/d)	$U = \frac{K \cdot I}{\theta_r}$	R19
Soil-Water Sorption Coefficient, k_s	$k_s = K_{oc} \cdot f_{oc}$	R20
Volumetric Air Content in Vadose Zone Soils, θ_{aa} (cm ³ _{air} /cm ³ _{soil})	$\theta_{aa} = \theta_r + \frac{(w \cdot \rho_s)}{\rho_w}$	R21
Volumetric Water Content in Vadose Zone Soils, θ_{wa} (cm ³ _{water} /cm ³ _{soil})	$\theta_{wa} = \frac{w \cdot \rho_s}{\rho_w}$	R22
Total Soil Porosity, θ_r (cm ³ /cm ³ _{soil})	$\theta_r = \theta_{aa} + \theta_{wa}$	R23

	Groundwater Darcy Velocity, U_{gw} (cm/s)	$U_{gw} = K \cdot I$	R24
Groundwater Migration	Cleanup Objective for Carcinogenic Contaminants (mg/L)	$\frac{TR \cdot BW \cdot AT_c \cdot 365 \frac{d}{yr}}{SF_o \cdot IR_w \cdot EF \cdot ED}$	R25
	Dissolved Hydrocarbon Concentration along Centerline, $C_{(x)}$ (g/cm ³)	$C_{(x)} = C_{source} \cdot \exp \left[\left(\frac{x}{2\alpha_t} \right) \left(1 - \sqrt{1 + \frac{4\lambda \cdot \alpha_x}{U}} \right) \right] \cdot \operatorname{erf} \left[\frac{S_w}{4 \cdot \sqrt{\alpha_y \cdot x}} \right] \cdot \operatorname{erf} \left[\frac{S_d}{4 \cdot \sqrt{\alpha_z \cdot x}} \right]$	R26

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Section 742.APPENDIX C: Tier 2 Tables and Illustrations

Table D: RBCA Parameters

Symbol	Parameter	Units	Source	Parameter Value(s)
AT_c	Averaging Time for Carcinogens	yr	RBCA	70
AT_n	Averaging Time for Noncarcinogens	yr	RBCA	Residential = 30 Industrial/Commercial = 25 Construction Worker = 0.173
BW	Adult Body Weight	kg	RBCA	70
C_{source}	Concentration of Contaminant in Groundwater at the Source.	mg/L	Field Measurement	Site-Specific
$C_{(x)}$	Concentration of Contaminant in Groundwater at Distance X from the source	mg/L	Equation R26 in Appendix C, Table C	Calculated Value
$C_{(x)}/C_{source}$	Steady-State Attenuation Along the Centerline of a Dissolved Plume		Equation R15 in Appendix C, Table C	Calculated Value
d	Lower Depth of Surficial Soil Zone	cm	Field Measurement	100 or Site-Specific (not to exceed 100)
D^a	Diffusion Coefficient in Air	cm^2/s	Appendix C, Table E	Chemical-Specific

Symbol	Parameter	Units	Source	Parameter Value(s)
D^{water}	Diffusion Coefficient in Water	cm ² /s	Chemistry & Physics Handbook	Chemical-Specific
D_e^{eff}	Effective Diffusion Coefficient in Soil Based on Vapor-Phase Concentration	cm ² /s	Equation R6 in Appendix C, Table C	Calculated Value
ED	Exposure Duration	yr	RBCA	Residential = 30 Industrial/Commercial = 25 Construction Worker = 1
EF	Exposure Frequency	d/yr	RBCA	Residential = 350 Industrial/Commercial = 250 Construction Worker = 45
erf	Error Function	unitless	Appendix C, Table G	Mathematical Function
f_{oc}	Organic Carbon Content of Soil	g/g	RBCA or Field Measurement (See Appendix C, Table F)	Surface Soil = 0.006 Subsurface Soil = 0.002 or Site-Specific
GW_{comp}	Groundwater Objective at the Compliance Point	mg/L	Field Measurement or IEPA Established	Site-Specific
GW_{source}	Groundwater Concentration at the Source	mg/L	Equation R13 in Appendix C, Table C	Calculated Value
H'	Henry's Law Constant	unitless	Appendix C, Table E	Chemical-Specific
i	Hydraulic Gradient	cm/cm (unitless)	Field Measurement (See Appendix C, Table F)	Site-Specific

Symbol	Parameter	Units	Source	Parameter Value(s)
I	Infiltration Rate	cm/yr	RBCA	30
IR _{air}	Daily Outdoor Inhalation Rate	m ³ /d	RBCA	20
IR _{soil}	Soil Ingestion Rate	mg/d	RBCA	Residential = 100 Industrial/Commercial = 50 Construction Worker = 480
IR _w	Daily Water Ingestion Rate	L/d	RBCA	Residential = 2 Industrial/Commercial = 1
K	Aquifer Hydraulic Conductivity	cm/d	Field Measurement (See Appendix C, Table F)	Site-Specific
K _{oc}	Organic Carbon Partition Coefficient	cm ³ /g or L/kg	Appendix C, Table E	Chemical-Specific
k _s	Soil Water Sorption Coefficient	(g/g _{soil})/(g/cm ³ _{water})	Equation R20 in Appendix C, Table C	Calculated Value
L _s	Depth to Subsurface Soil Sources	cm	RBCA	100
LF _w	Leaching Factor	(mg/L _{water})/(mg/kg _{soil})	Equation R14 in Appendix C, Table C	Calculated Value
M	Soil to Skin Adherence Factor	mg/cm ²	RBCA	0.5
Pe	Particulate Emission Rate	g/cm ² -s	RBCA	6.9 • 10 ⁻¹⁴
RAF _d (volatiles)	Dermal Relative Absorption Factor	unitless	RBCA	0.5
RAF _d (PNAs)	Dermal Relative Absorption Factor	unitless	RBCA	0.05

Symbol	Parameter	Units	Source	Parameter Value(s)
RAF _o	Oral Relative Absorption Factor	unitless	RBCA	1.0
RBSL _{air}	Carcinogenic Risk-Based Screening Level for Air	ug/m ³	Equation R9 in Appendix C, Table C	Chemical-, Media-, and Exposure Route-Specific
RBSL _{soil}	Noncarcinogenic Risk-Based Screening Level for Air	ug/m ³	Equations R10 in Appendix C, Table C	Chemical-, Media-, and Exposure Route-Specific
RfD _i	Inhalation Reference Dose	mg/kg-d	IEPA (IRIS/HEAST)	Toxicological-Specific
RfD _o	Oral Reference Dose	mg/(kg-d)	IEPA (IRIS)	Toxicological-Specific (Note: for Construction Worker use subchronic reference doses)
SA	Skin Surface Area	cm ² /d	RBCA	3,160
S _v	Source Width Perpendicular to Groundwater Flow Direction in Vertical Plane	cm	Field Measurement	For Migration to Groundwater Route: Use 200 or Site-Specific For Groundwater cleanup objective: Use Site-Specific
S _h	Source Width Perpendicular to Groundwater Flow Direction in Horizontal Plane	cm	Field Measurement	Site-Specific
SF _i	Inhalation Cancer Slope Factor	(mg/kg-d) ⁻¹	IEPA (IRIS/HEAST)	Toxicological-Specific
SF _o	Oral Slope Factor	(mg/kg-d) ⁻¹	IEPA (IRIS/HEAST)	Toxicological-Specific

Symbol	Parameter	Units	Source	Parameter Value(s)
THQ	Target Hazard Quotient	unitless	RBCA	1
TR	Target Cancer Risk	unitless	RBCA	Residential = 10^{-4} to 10^{-6} Industrial/Commercial = 10^{-4} to 10^{-6} Construction Worker = 10^{-4} to 10^{-6}
U	Specific Discharge	cm/d	Equation R19 in Appendix C, Table C	Calculated Value
U_{av}	Average Wind Speed Above Ground Surface in Ambient Mixing Zone	cm/s	RBCA	225
U_{gw}	Groundwater Darcy Velocity	cm/s	Equation R24 in Appendix C, Table C	Calculated Value
VF_p	Volatization Factor for Surficial Soils Regarding Particulates	kg/m ³	Equation R5 in Appendix C, Table C	Calculated Value
VF_{sub}	Volatization Factor (Subsurface Soils to Ambient Air)	(mg/m ³ _{air})/(mg/kg _{soil}) or kg/m ³	Equation R11 in Appendix C, Table C	Calculated Value
VF_m	Volatization Factor for Surficial Soils	kg/m ³	Use Equations R3 and R4 in Appendix C, Table C	Calculated Value from Equation R3 or R4 (whichever is less)
W	Width of Source Area Parallel to Direction to Wind or Groundwater Movement	cm	Field Measurement	Site-Specific

Symbol	Parameter	Units	Source	Parameter Value(s)
w	Average Soil Moisture Content	B_{water}/B_{soil}	RBCA or Field Measurement (See Appendix C, Table F)	0.1, or Surface Soil (top 1 meter) = 0.1 Subsurface Soil (below 1 meter) = 0.2, or Site-Specific
X	Distance along the Centerline of the Groundwater Plume Emanating from a Source. The x direction is the direction of groundwater flow	cm	Field Measurement	Site-Specific
α_x	Longitudinal Dispersivity	cm	Equation R16 in Appendix C, Table C	Calculated Value
α_y	Transverse Dispersivity	cm	Equation R17 in Appendix C, Table C	Calculated Value
α_z	Vertical Dispersivity	cm	Equation R18 in Appendix C, Table C	Calculated Value
δ_{air}	Ambient Air Mixing Zone Height	cm	RBCA	200
δ_{gw}	Groundwater Mixing Zone Thickness	cm	RBCA	200

Symbol	Parameter	Units	Source	Parameter Value(s)
θ_a	Volumetric Air Content in Vadose Zone Soils	$\text{cm}^3_{\text{air}}/\text{cm}^3_{\text{soil}}$	RBCA or Equation R21 in Appendix C, Table C	Surface Soil (top 1 meter) = 0.28 Subsurface Soil (below 1 meter) = 0.13, or Gravel = 0.05 Sand = 0.14 Silt = 0.16 Clay = 0.17, or Calculated Value
θ_w	Volumetric Water Content in Vadose Zone Soils	$\text{cm}^3_{\text{water}}/\text{cm}^3_{\text{soil}}$	RBCA or Equation R22 in Appendix C, Table C	Surface Soil (top 1 meter) = 0.15 Subsurface Soil (below 1 meter) = 0.30, or Gravel = 0.20 Sand = 0.18 Silt = 0.16 Clay = 0.17, or Calculated Value
θ_T	Total Soil Porosity	$\text{cm}^3/\text{cm}^3_{\text{soil}}$	RBCA or Equation R23 in Appendix C, Table C	0.43, or Gravel = 0.25 Sand = 0.32 Silt = 0.40 Clay = 0.36, or Calculated Value
λ	First Order Degradation Constant	d^{-1}	Appendix C, Table E	Chemical-Specific

Symbol	Parameter	Units	Source	Parameter Value(s)
π	pi			3.1416
ρ_s	Soil Bulk Density	g/cm ³	RBCA or Field Measurement (See Appendix C, Table F)	1.5, or Gravel = 2.0 Sand = 1.8 Silt = 1.6 Clay = 1.7, or Site-Specific
ρ_w	Water Density	g/cm ³	RBCA	1
τ	Averaging Time for Vapor Flux	s	RBCA	9.46 X 10 ⁹

Section 742.APPENDIX C: Tier 2 Tables and Illustrations

Table E: Default Physical and Chemical Parameters

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (Di) (cm ² /s)	Dimensionless Henry's Law Constant (H') (25°C)	Organic Carbon Partition Coefficient (K _{oc}) (L/kg)	First Order Degradation Constant (λ) (d ⁻¹)
Neutral Organics						
83-32-9	Acenaphthene	4.13	0.0421	0.0075	4,900	0.0034
67-64-1	Acetone	604,000	0.124	0.0012	0.460	0.0495
309-00-2	Aldrin	0.0784	0.0132	0.0042	48,400	0.00059
120-12-7	Anthracene	0.0537	0.0324	0.0046	21,200	0.00075
71-43-2	Benzene	1,780	0.0870	0.22	57.0	0.0009
56-55-3	Benzo(a)anthracene	0.0128	0.0510	0.00015	357,000	0.00051
205-99-2	Benzo(b)fluoranthene	0.00433	0.0226	0.00025	883,000	0.00057
207-08-9	Benzo(k)fluoranthene	0.00433	0.0226	0.00025	883,000	0.00016
65-85-0	Benzoic Acid	3,130	0.0536	0.000014	0.600	No Data
50-32-8	Benzo(a)pyrene	0.00194	0.043	0.000034	916,000	0.00065

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (Di) (cm ² /s)	Dimensionless Henry's Law Constant (H') (25°C)	Organic Carbon Partition Coefficient (K _{oc}) (L/kg)	First Order Degradation Constant (λ) (d ⁻¹)
111-44-4	Bis(2-chloroethyl)ether	11,800	0.0692	0.00088	76.0	0.0019
117-81-7	Bis(2-ethylhexyl)phthalate	0.396	0.0351	0.00034	87,400	0.0018
75-27-4	Bromodichloromethane	3,970	0.0298	0.13	54.0	No Data
75-25-2	Bromoform	3,210	0.0149	0.025	126	0.0019
71-36-3	Butanol	74,700	0.0800	0.00035	5.00	0.01283
85-68-7	Butyl Benzyl Phthalate	2.58	0.0172	0.000078	34,100	0.00385
86-74-8	Carbazole	0.721	0.0390	0.0033	2,440	No Data
75-15-0	Carbon Disulfide	2,670	0.104	0.52	52.0	No Data
56-23-5	Carbon Tetrachloride	792	0.0780	1.2	164	0.0019
57-74-9	Chlordane	0.219	0.0118	0.0027	51,300	0.00025
106-47-8	p-Chloroaniline	3,360	0.0483	0.000048	41.0	No Data
108-09-7	Chlorobenzene	409	0.0730	0.18	204	0.0023
124-48-1	Chlorodibromomethane	3,440	0.0229	0.10	72.0	0.00385

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (Di) (cm ² /s)	Dimensionless Henry's Law Constant (H') (25°C)	Organic Carbon Partition Coefficient (K _{oc}) (L/kg)	First Order Degradation Constant (λ) (d ⁻¹)
67-66-3	Chloroform	7,960	0.104	0.16	56.0	0.00039
95-57-8	2-Chlorophenol	21,500	0.0501	0.00068	391	No Data
218-01-9	Chrysene	0.00194	0.0248	0.000050	312,000	0.00035
72-54-8	4,4'-DDD	0.0733	0.0156	0.00020	84,900	0.000062
72-55-9	4,4'-DDE	0.0192	0.0144	0.0051	86,400	0.000062
50-29-3	4,4'-DDT	0.00341	0.0137	0.0022	237,000	0.000062
53-70-3	Dibenzo(a,h)anthracene	0.000670	0.0200	0.00000046	1,800,000	0.00037.
84-74-2	Di-n-butyl Phthalate	10.8	0.0438	0.000059	1,570	0.03013
95-50-1	1,2-Dichlorobenzene	125	0.0690	0.086	376	0.0019
106-46-7	1,4-Dichlorobenzene	73.0	0.0690	0.12	516	0.0019
91-94-1	3,3-Dichlorobenzidine	3.52	0.0194	0.00000085	2,440	0.0019
75-34-3	1,1-Dichloroethane	5,160	0.0742	0.24	52.0	0.0019
107-06-2	1,2-Dichloroethane	8,310	0.104	0.052	38.0	0.0019
75-35-4	1,1-Dichloroethylene	3,000	0.0900	1.0	65.0	0.0053

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (Di) (cm ² /s)	Dimensionless Henry's Law Constant (H') (25°C)	Organic Carbon Partition Coefficient (K _{oc}) (L/kg)	First Order Degradation Constant (λ) (d ⁻¹)
156-59-2	cis-1,2-Dichloroethylene	4,940	0.0736	0.18	29.0	0.00024
156-60-5	trans-1,2-Dichloroethylene	8,030	0.0707	0.23	50.0	0.00024
120-83-2	2,4-Dichlorophenol	4,930	0.0346	0.0000098	146	0.00027
78-87-5	1,2-Dichloropropane	2,680	0.0782	0.12	47.0	0.00027
542-75-6	1,3-Dichloropropylene (cis + trans)	1,550	0.0626	0.12	26.0	0.061
60-57-1	Dieldrin	0.187	0.0125	0.00011	10,900	0.00032
84-66-2	Diethyl Phthalate	883	0.0256	0.000022	82.0	0.00619
105-67-9	2,4-Dimethylphenol	6,250	0.0584	0.00013	126	0.0495
131-11-3	Dimethyl Phthalate	4,190	0.0568	0.000024	46.0	0.0495
51-28-5	2,4-Dinitrophenol	5,800	0.0273	0.00000020	0.01	0.00132
121-14-2	2,4-Dinitrotoluene	285	0.203	0.0000060	51.0	0.00192
606-20-2	2,6-Dinitrotoluene	1,050	0.0349	0.0000053	42.0	0.00192

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (Di) (cm ² /s)	Dimensionless Henry's Law Constant (H') (25°C)	Organic Carbon Partition Coefficient (K _{oc}) (L/kg)	First Order Degradation Constant (λ) (d ⁻¹)
117-84-0	Di-n-octyl Phthalate	3.00	0.0151	0.000031	980,000,000	0.0019
115-29-7	Endosulfan	0.231	0.0115	0.00095	738	0.07629
72-20-8	Endrin	0.246	0.0125	0.000049	10,800	0.00032
100-41-4	Ethylbenzene	173	0.0750	0.32	221	0.003
206-44-0	Fluoranthene	0.232	0.0302	0.00038	49,100	0.00019
86-73-7	Fluorene	1.86	0.0363	0.003	7,960	0.000691
76-44-8	Heptachlor	0.273	0.0112	0.024	6,810	0.13
1024-57-3	Heptachlor epoxide	0.268	0.0122	0.00034	7,240	0.00063
118-74-1	Hexachlorobenzene	0.00862	0.0542	0.022	37,500	0.00017
319-84-6	alpha-HCH (alpha-BHC)	2.40	0.0176	0.00028	1,760	0.0025
58-89-9	gamma-HCH (Lindane)	4.20	0.0176	0.00014	1,380	0.0029
77-47-4	Hexachlorocyclopentadiene	1.53	0.0161	0.70	9,590	0.012

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (Di) (cm ² /s)	Dimensionless Henry's Law Constant (H') (25°C)	Organic Carbon Partition Coefficient (K _{oc}) (L/kg)	First Order Degradation Constant (λ) (d ⁻¹)
67-72-1	Hexachloroethane	40.8	0.00249	0.15	1,830	0.00192
193-39-5	Indeno(1,2,3-c,d)pyrene	0.0107	0.0190	0.00000020	4,360,000	0.00047
78-59-1	Isophorone	12,000	0.0623	0.00025	30.0	0.01238
7439-97-6	Mercury	---	0.130	0.47	---	No Data
72-43-5	Methoxychlor	0.0884	0.0156	0.00026	77,900	0.0019
74-83-9	Methyl Bromide	14,500	0.0728	0.58	9.49	0.01824
75-09-2	Methylene Chloride	17,400	0.101	0.097	16.0	0.012
95-48-7	2-Methylphenol	27,700	0.0740	0.000067	54.0	0.0495
91-20-3	Naphthalene	31.1	0.0590	0.020	964	0.0027
98-95-3	Nitrobenzene	1,920	0.0760	0.00084	131	0.00176
86-30-6	N-Nitrosodiphenylamine	37.4	0.0293	0.029	327	0.01
621-64-7	N-Nitrosodi-n-propylamine	14,600	0.0513	0.0017	17.0	0.0019

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (D _i) (cm ² /s)	Dimensionless Henry's Law Constant (H') (25°C)	Organic Carbon Partition Coefficient (K _{oc}) (L/kg)	First Order Degradation Constant (λ) (d ⁻¹)
87-86-5	Pentachlorophenol	13.4	0.0560	0.00058	----- ^b	0.00045
108-95-2	Phenol	90,800	0.0820	0.000024	----- ^b	0.099
1336-36-3	Polychlorinated biphenyls (PCBs)	----- ^a	----- ^a	----- ^a	----- ^a	No Data
129-00-0	Pyrene	0.137	0.0272	0.00034	68,200	0.00018
100-42-5	Styrene	257	0.0710	0.14	912	0.0033
127-18-4	Tetrachloroethylene	23.2	0.0720	0.71	300	0.00096
108-88-3	Toluene	558	0.0870	0.25	131	0.011
8001-35-2	Toxaphene	0.679	0.0116	0.00014	501	No Data
120-82-1	1,2,4-Trichlorobenzene	30.7	0.0300	0.11	1,540	0.0019
71-55-6	1,1,1-Trichloroethane	1,170	0.0780	0.76	99.0	0.0013
79-00-5	1,1,2-Trichloroethane	4,400	0.0780	0.041	76.0	0.00095
79-01-6	Trichloroethylene	1,180	0.0790	0.43	94.0	0.00042
95-95-4	2,4,5-Trichlorophenol	965	0.0291	0.00018	1,400	0.00038

CAS No.	Chemical	Solubility in Water (S) (mg/L)	Diffusivity in Air (Di) (cm ² /s)	Dimensionless Henry's Law Constant (H') (25°C)	Organic Carbon Partition Coefficient (K _{oc}) (L/kg)	First Order Degradation Constant (λ) (d ⁻¹)
88-06-2	2,4,6-Trichlorophenol	753	0.0314	0.00017	----- ^b	0.00038
108-05-4	Vinyl Acetate	22,400	0.0850	0.023	5.00	No Data
57-01-4	Vinyl Chloride	2,730	0.106	3.5	11.0	0.00024
1330-20-7	Xylenes (total)	186	0.0720	0.25	260	0.0019

Chemical Abstracts Service (CAS) registry number. This number in the format xxx-xx-x, is unique for each chemical and allows efficient searching on computerized data bases.

^aSoil Remediation objectives are determined pursuant to 40 CFR 761.120, as incorporated by reference at Section 732.104 (the USEPA "PCB Spill Cleanup Policy"), for most sites; persons remediating sites should consult with BOL if calculation of Tier 2 soil remediation objectives is desired.

^bVariable, depending on pH: consult with IEPA after determining soil pH for appropriate K_{oc}.

Table F: Methods for Determining Physical Soil Parameters

Methods for Determining Physical Soil Parameters		
Parameter	Sampling Location ^a	Method
ρ_b (soil bulk density)	Surface	ASTM - D 1556 Sand Cone Method ^b
		ASTM - D 2167 Rubber Balloon Method ^b
		ASTM - D 2922-91 Nuclear Method ^b
	Subsurface	ASTM - D 2937 Drive Cylinder Method ^b
ρ_s (soil particle density)	Surface or Subsurface	ASTM - D 854 Specific Gravity of Soil ^b
w (moisture content)	Surface or Subsurface	ASTM - D 4959-89 Standard ^b
		ASTM - D 4643-93 Microwave Oven ^b
f_{oc} (organic carbon content)	Surface or Subsurface	Nelson and Sommers (1982)
		ASTM - D 2974-87 ^b
η or θ_T (total soil porosity)	Surface or Subsurface (calculated)	$\eta = 1 - \rho_b/\rho_s$ $\theta_T = \theta_a + \theta_w$
θ_a or θ_{aT} (air-filled soil porosity)	Surface or Subsurface (calculated)	$\eta - [(w \cdot \rho_b)/\rho_w]$
θ_w or θ_{wT} (water-filled soil porosity)	Surface or Subsurface (calculated)	$(w \cdot \rho_b)/\rho_w$
K (hydraulic conductivity)	Surface or Subsurface	ASTM - D 5084 ^b
		Pump Test
		Slug Test
i (hydraulic gradient)	Surface or Subsurface	Field Measurement

^a This is the location where the sample is collected^b As incorporated by reference in Section 742.120.

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Section 742.APPENDIX C:

Tier 2 Tables and Illustrations

Table G: Error Function (erf)

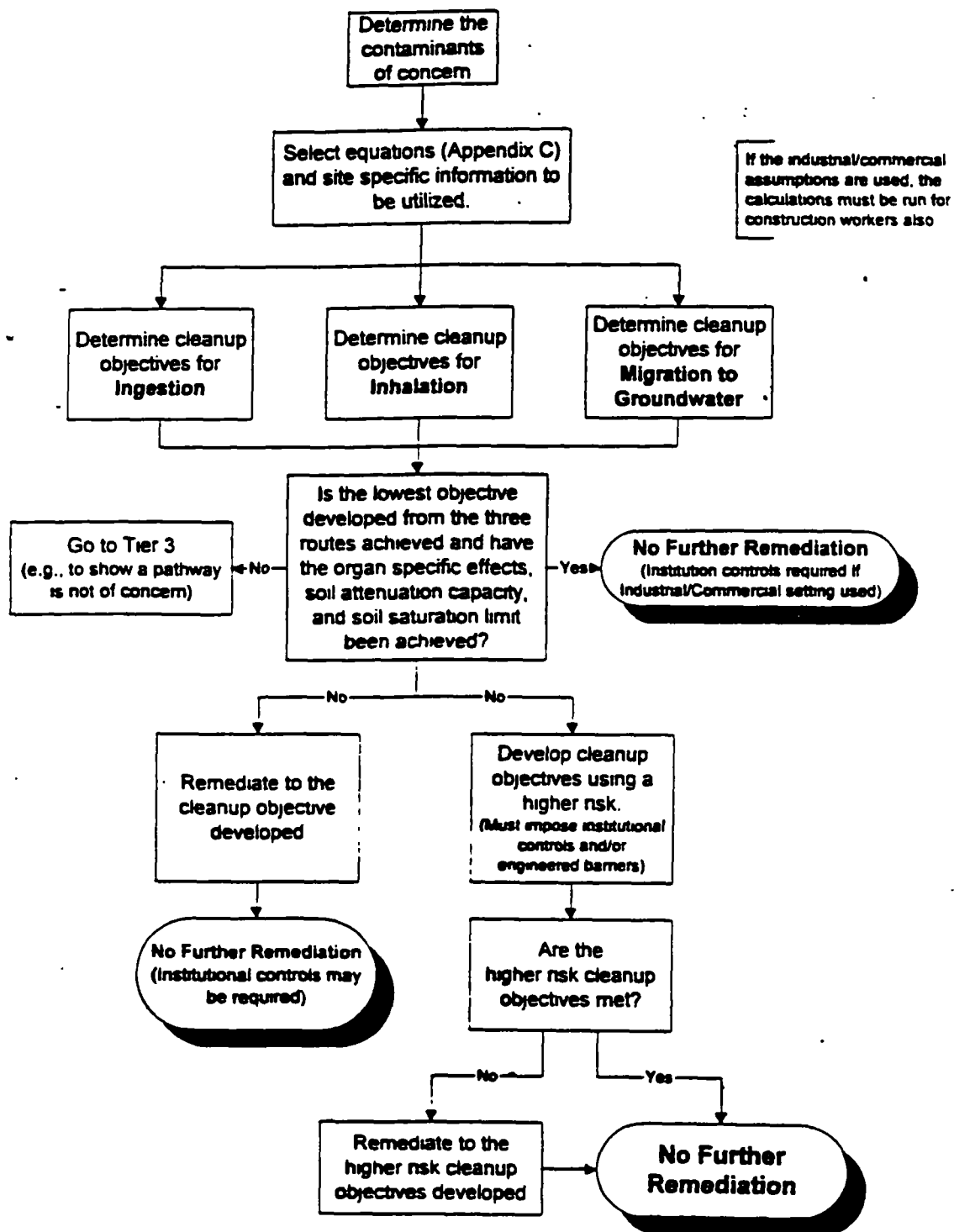
$$\text{erf}(\beta) = \frac{2}{\sqrt{\pi}} \int_0^{\beta} e^{-t^2} dt$$

β	$\text{erf}(\beta)$
0	0
0.05	0.056372
0.1	0.112463
0.15	0.167996
0.2	0.222703
0.25	0.276326
0.3	0.328627
0.35	0.379382
0.4	0.428392
0.45	0.475482
0.5	0.520500
0.55	0.563323
0.6	0.603856
0.65	0.642029
0.7	0.677801
0.75	0.711156
0.8	0.742101
0.85	0.770668
0.9	0.796908
0.95	0.820891

1.0	0.842701
1.1	0.880205
1.2	0.910314
1.3	0.934008
1.4	0.952285
1.5	0.966105
1.6	0.976348
1.7	0.983790
1.8	0.989091
1.9	0.992790
2.0	0.995322
2.1	0.997021
2.2	0.998137
2.3	0.998857
2.4	0.999311
2.5	0.999593
2.6	0.999764
2.7	0.999866
2.8	0.999925
2.9	0.999959
3.0	0.999978

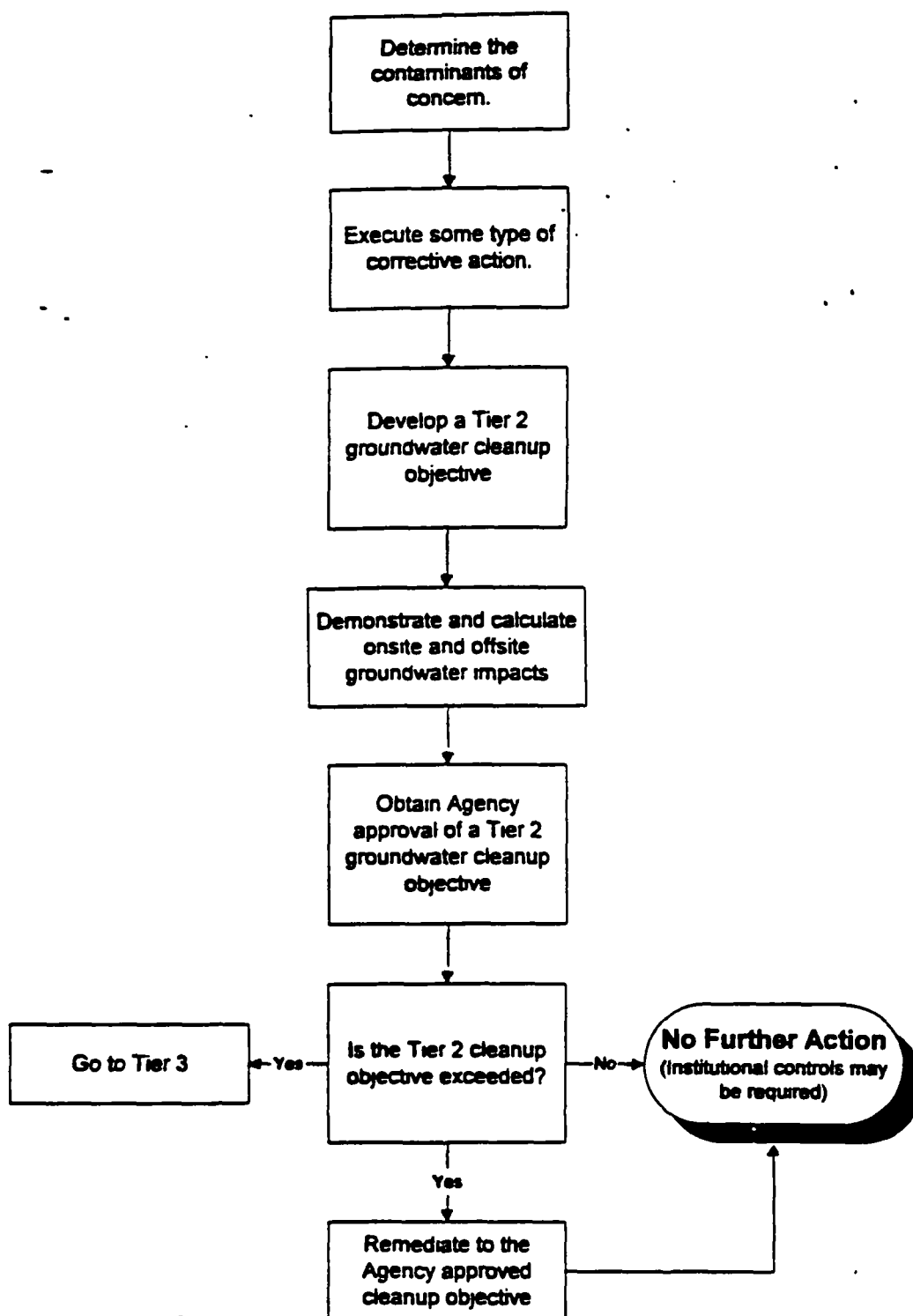
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Illustration A: Tier 2 Evaluation for Soil



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Illustration B: Tier 2 Evaluation for Groundwater



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Section 742.APPENDIX D:

Procedures for Determination of Class II Groundwater

The following is a procedure to demonstrate that groundwater beneath a site does not meet the Class I criteria set forth in 35 Ill. Adm. Code 620.210 and therefore, need only meet the Class II groundwater quality standards. Groundwater is classified in 35 Ill. Adm. Code 620 as a Class II, general resource groundwater when it:

- 1) Does not meet the provisions of 35 Ill. Adm. Code 620.230 (Class III) or 35 Ill. Adm. Code 620.240 (Class IV); (Determining whether the groundwater is Class III or Class IV is relatively straight forward, as is the requirement to determine if the groundwater has previously been classified as Class II groundwater by the Illinois Pollution Control Board (Board).) or,
- 2) - Has been found by the Board to be a Class II groundwater, pursuant to the petition procedures set forth in 35 Ill. Adm. Code 620.260; (if a continuous zone containing groundwater begins within 10 feet of the ground surface and extends greater than ten feet below the ground surface it will not be considered a Class II groundwater if an additional criterion is met under 35 Ill. Adm. Code 620.210, in this case it would be considered Class I groundwater. Although it may be possible, it is unrealistic to try to designate two distinct classes of groundwater within the same saturated hydrogeologic unit. But, if the person conducting the remediation can demonstrate that by cleaning the groundwater within ten feet of the surface to Class II specifications will not degrade the groundwater greater than 10 feet below the ground surface above Class I standards, the Agency may approve both Class I and II standards in accordance with the location of the groundwater.) or,
- 3) Is located less than ten feet below the ground surface; or,
- 4) Does not meet the provisions of 35 Ill. Adm. Code 620.210, which is further discussed in paragraphs (A) through (D) below.

Initially, the sources of information listed below should be considered to determine the appropriate classification of groundwater:

- 1) Published data concerning regional and local geologic and hydrogeologic conditions (i.e. geologic surveys, former site investigations, etc.).
- 2) The locations of all potable water wells located within one mile of the site with the logs and/or dates of well completion attached.
- 3) Available data on-site boring logs which characterize the geology from ground surface to the first saturated unit or, if a perched zone is present, the first

saturated unit below the perched zone.

If after collecting and reviewing the above information the groundwater is clearly not a Class II groundwater and one still wishes to pursue classification as Class II groundwater, further investigation including site-specific information must be utilized to make a determination that the groundwater is subject to the Class II standards. If the site geology or hydrogeologic properties pass all criteria listed below, the groundwater is a Class II groundwater. The information requirements listed describe the minimum documentation which should be provided to the Agency.

- A) Groundwater cannot be located within the minimum setback of a well which serves as a potable water supply and to the bottom of such well;

The minimum setback zone of a well extends from the land surface to the bottom of the well as determined by the screen depth. This establishes a three-dimensional zone of protection around the well.

Section 14 of the Environmental Protection Act (Act) established setback requirements for potable water supply wells and potential sources/routes of contamination. Unless regulatory relief consistent with this Section of the Act has been sought and received, no new sources/routes may be located within 200 feet of a potable water supply well or 400 feet of a vulnerable community water supply well. Further, the converse of this statement also applies (e.g., no new potable water supply well may locate within 200 feet of a current or future source/route). A 400 foot separation is required for a vulnerable community water supply well. In addition, a community water supply may establish maximum setback zones of up to 1,000 feet around the wells. This may cause further siting restrictions for new activities as well as require technology controls under 35 Ill. Adm. Code 615/616 for existing and new activities.

This requirement may be satisfied by the submission of a scaled map delineating the site and all potable water wells located within a one mile radius from the unit(s) of concern. The Illinois State Water Survey and/or the Division of Public Water Supplies of the Agency should be contacted, as well as other appropriate state and federal entities, to obtain this information. A copy of the state or federal agency's response to an information inquiry should be included with the information submitted by the person conducting the remediation. Also, a visual inspection of the area within 200 feet of the unit(s) of concern should be conducted when possible to detect unplugged private wells.

- B) Formations beneath the site cannot consist of unconsolidated sand, gravel, or sand and gravel which is 5 feet or more in thickness and that contains 12 percent or less in fines (i.e. fines which pass through a No. 200 sieve tested according to ASTM Standard Practice D2488-93);

This criterion is specific to the type of formations listed. If a zone of saturation fails this Class II criterion, Class II may still apply pursuant to D below.

This criterion may be satisfied by the submission of, at a minimum, one site-specific, continuously sampled boring log which clearly identifies the saturated interval from which a representative sample was obtained. Sieve test analysis should be conducted on several samples from each saturated interval which is at least five feet in thickness and composed of sand-sized grains or greater. In addition, the person conducting the remediation should submit the sieve data sheet, plot, and a scaled map which identifies the location of each boring.

- C) Formations beneath the site cannot consist of sandstone which is 10 feet or more in thickness, or fractured carbonate which is 15 feet or more in thickness; or

This requirement may be satisfied by the submission of, at a minimum, one site-specific, continuously sampled boring log with a description of the geologic material present. This boring log should extend from the ground surface to a depth which is 10 feet into the uppermost water-bearing unit subject to Class I standards or bedrock, whichever is shallower. The boring(s) should be continuously sampled and located on a scaled site map. A representative sample, as used previously, is a sample obtained from each distinctive saturated unit within the boring. Also, a literature search of regional and local geologic conditions should be conducted with the results submitted to the Agency.

- D) Class II shall not include any geologic material which is shown capable of either of the following:

- Sustained groundwater yield, from up to a 12 inch borehole, of 150 gallons per day or more from a thickness of 15 feet or less; or

This requirement may be satisfied by the submission of continuously sampled boring logs which demonstrate aquifer thickness. In addition, as-built well construction diagrams should also be submitted to the Agency for review. Furthermore, a pump test or equivalent must be conducted to determine the yield of the geologic material. Methodology, assumptions, and any calculations performed should also be submitted to meet this requirement. If the aquifer geometry and transmissivity have been obtained through a site-specific field investigation, an analytical solution may be used to estimate well yield. The person conducting the remediation must demonstrate the appropriateness of an analytical solution to estimate well yield versus an actual field test. Well yield should be determined for either confined or unconfined conditions.

The pump test should consider some minimum pumping rate during the test; the following criteria should be used:

- i) If all areas within 200 feet of the site have access to a water main to provide drinking water from a public water supply system, then a minimum pumping rate of 4 gallons per minute should be used when performing this test.
 - ii) If all areas within 200 feet of the site do not have access to a water main to provide drinking water from a public water supply system, then a minimum pumping rate of 0.5 gallons per minute should be used when performing this test.
- Hydraulic conductivity of 1×10^{-4} cm/sec or greater using one of the following test methods or its equivalent:

This requirement may be satisfied by performing field and/or lab tests such as a permeameter, slug test, and/or pump test.

An appropriate method of evaluation should be chosen based on the type of wells, the length of time over which data may need to be collected and, if known, the characteristics of the targeted aquifer. Such methods and the suggested information to be submitted to the Agency are outlined below and shall include at least one of the following:

i) Permeameter

If this method is chosen, samples of unconsolidated materials should be left in the field-sampling tubes which then become the permeameter sample chamber. Proceeding in this manner should allow as little disruption to the sample as possible. Unconsolidated samples should not be repacked into the sample chamber. An outline of the laboratory test method used and a description of the steps followed including any calculations should be submitted to the Agency for review.

ii) Slug tests

This information to be submitted to the Agency should include a description of the slug test method utilized and a discussion of the procedures followed during the tests, including any calculations performed.

A significant drawback to performing a slug test is that it is heavily

dependent on a high-quality intake. If a well point is clogged or corroded, measured values may be inaccurate. Also, if a well is developed by surging or backwashing prior to testing, the measured values may reflect increased conductivities in the artificially included gravel pack around the intake. If slug tests are chosen, a sufficient number of tests should be run to ensure that representative measures of hydraulic conductivities have been obtained and that lateral variations at various depths are documented.

- iii) Pump tests

Preliminary or short-term drawdown tests should be performed initially to assess the appropriate pumping rate for the constant-rate tests. Several methods and/or equations may be used in evaluating data generated from pump tests such as Theis, Hantush-OJacob, Hvorslev and/or Theim equations. The method(s) of evaluation selected should be provided to the Agency with justification for their use, explanations of any assumptions made and examples of all calculations performed along with a description of the physical tests performed including the type of pump used.

NOTE: It may be beneficial to use laboratory evaluation methods to further support results of field tests; however, field methods provide the best definition of the hydraulic conductivity in most cases. The most appropriate method to determine hydraulic conductivity for most sites will be the pump test provided proper evaluation of the data obtained from the test is utilized. Pump tests provide in-situ measurements that are averaged over a large aquifer volume and are preferred since they are able to characterize a greater portion of the subsurface compared to the other aquifer tests. Slug tests provide in-situ values representative of a small volume of porous media in the immediate vicinity of a piezometer tip, providing point values only, and may be more appropriate in very low-permeability materials in which conductivity is too small to conduct a pump test.



IEPA SOIL CLEANUP OBJECTIVES



DRAFT

May 8, 1995

Section 859. Appendix A

Groundwater and Soil Remediation Objectives; and Acceptable Detection Limits (ADL) and Soil Remediation Methodology

Table A Groundwater Remediation Objectives

Objectives Groundwater (mg/l)

CAS No.	Chemical	Class I Baseline	Class II Baseline
Volatiles			
67-64-1	Acetone	0.7	0.7
71-43-2	Benzene	0.005	0.025
75-25-2	Bromoform	0.001*	0.001
71-36-3	n-Butanol	0.7	0.7
75-15-0	Carbon Disulfide	0.7	0.7
56-23-5	Carbon tetrachloride	0.005	0.025
108-90-7	Chlorobenzene	0.1	0.5
124-48-1	Chlorodibromomethane	0.14	0.14
67-66-3	Chloroform	0.0002*	0.001
75-27-4	Dichlorobromomethane	0.0002*	0.001
75-34-3	1,1-Dichloroethane	0.7	3.5
107-06-2	1,2-Dichloroethane	0.005	0.025
75-35-4	1,1-Dichloroethylene	0.007	0.035
156-59-2	<i>cis</i> -1,2-Dichloroethylene	0.07	0.2
156-60-5	<i>trans</i> -1,2-Dichloroethylene	0.1	0.5
75-09-2	Dichloromethane (Methylene chloride)	0.005	0.05
78-87-5	1,2-Dichloropropane	0.005	0.025
542-75-6	1,3-Dichloropropylene (<i>cis</i> + <i>trans</i>)	0.001*	0.005
121-14-2	2,4-Dinitrotoluene	0.14	0.14
606-20-2	2,6-Dinitrotoluene	0.07	0.07
100-41-4	Ethylbenzene	0.7	1.0

May 8, 1995

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CAS No.	Chemical	Class I Baseline	Class II Baseline
67-72-1	Hexachloroethane	0.007	0.007
74-83-9	Methyl Bromide	0.0098	0.0098
98-95-3	Nitrobenzene	0.0035	0.0035
100-42-5	Styrene	0.1	0.5
79-34-5	1,1,2,2-Tetrachloroethane	0.21	0.21
127-18-4	Tetrachloroethylene	0.005	0.025
108-88-3	Toluene	1.0	2.5
71-55-6	1,1,1-Trichloroethane	0.2	1.0
79-00-5	1,1,2-Trichloroethane	0.005	0.05
79-01-6	Trichloroethylene	0.005	0.025
108-05-4	Vinyl Acetate	7.0	7.0
75-01-4	Vinyl chloride	0.002	0.01
1330-20-7	Xylenes (total)	10.0	10.0
Base/Neutrals			
111-44-4	Bis(2-chloroethyl)ether	0.01*	0.01
117-81-7	Bis(2-ethylhexyl)phthalate	0.006*	0.06
85-68-7	Butyl Benzyl Phthalate	1.4	7.0
86-74-8	Carbazole	ADL (NA)	ADL X 5
84-74-2	Di-n-butyl Phthalate	0.7	3.5
95-50-1	1,2-Dichlorobenzene	0.6	1.5
106-46-7	1,4-Dichlorobenzene	0.075	0.375
91-94-1	3,3'-Dichlorobenzidine	0.02	0.1
84-66-2	Diethyl Phthalate	5.6	5.6
31-11-3	Dimethyl Phthalate	7.0	7.0
118-74-1	Hexachlorobenzene	0.0005*	0.0025
77-47-4	Hexachlorocyclopentadiene	0.05	0.5
78-59-1	Isophorone	1.4	1.4

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CAS No.	Chemical	Class I Baseline	Class II Baseline
621-64-7	<i>n</i> -Nitrosodi- <i>n</i> -propylamine	0.01*	0.01
86-30-6	<i>n</i> -Nitrosodiphenylamine	0.01*	0.01
120-82-1	1,2,4-Trichlorobenzene	0.07	0.7
Polynuclear Aromatics			
83-32-9	Acenaphthene	0.42	2.1
120-12-7	Anthracene	2.1	10.5
56-55-3	Benzo(a)anthracene	0.00013*	0.00065
50-32-8	Benzo(a)pyrene	0.0002*	0.002
205-99-2	Benzo(b)fluoranthene	0.00018*	0.0009
207-08-9	Benzo(k)fluoranthene	0.00017*	0.00085
218-01-9	Chrysene	0.0015*	0.0075
53-70-3	Dibenzo(a,h)anthracene	0.0003*	0.0015
206-44-0	Fluoranthene	0.28	1.4
86-73-7	Fluorene	0.28	1.4
193-39-5	Indeno(1,2,3-c,d)pyrene	0.00043*	0.00215
91-20-3	Naphthalene	0.025	0.039
129-00-0	Pyrene	0.21	1.05
	Other Non-Carcinogenic PNAs (total)	0.21	1.05
208-96-8	Acenaphthylene		
191-24-2	Benzo(g,h,i)perylene		
85-01-8	Phenanthrene		
Metals (total inorganic and organic forms)			
7440-36-0	Antimony	0.006	0.024
7440-38-2	Arsenic	0.05	0.2
7440-39-3	Barium	2.0	2.0
7440-41-7	Beryllium	0.004	No Data

May 8, 1995

DATA

CAS No.	Chemical	Class I Baseline	Class II Baseline
7440-43-9	Cadmium	0.005	0.05
7440-47-3	Chromium (total)	0.1	1.0
7439-92-1	Lead	0.0075	0.1
7439-97-6	Mercury	0.002	0.01
7440-02-0	Nickel	0.1	2.0
7782-49-2	Selenium	0.05	0.05
7440-22-4	Silver	0.05	—
7440-28-0	Thallium	0.002	0.02
7440-66-6	Zinc	5.0	10
57-12-5	Cyanide	0.2	0.6
Acids			
65-85-0	Benzoic Acid	28	28
106-47-8	<i>p</i> -Chloroaniline	0.028	0.028
95-57-8	2-Chlorophenol	0.035	0.035
120-83-2	2,4-Dichlorophenol	0.021	0.021
105-67-9	2,4-Dimethylphenol	0.14	0.14
51-28-5	2,4-Dinitrophenol	0.014	0.014
95-48-7	2-Methylphenol	0.35	0.35
86-30-6	<i>N</i> -Nitrosodiphenylamine	0.01	0.01
621-64-7	<i>N</i> -Nitrosodi- <i>n</i> -propylamine	0.01	0.01
87-86-5	Pentachlorophenol	0.001*	0.005
108-95-2	Phenol (total)	0.1	0.1
95-95-4	2,4,5-Trichlorophenol	0.7	3.5
88-06-2	2,4,6-Trichlorophenol	0.0064*	0.0064
Pesticides			
309-00-2	Aldrin	0.00004*	0.0002
319-84-6	<i>alpha</i> -BHC	0.00003*	0.00015

May 8, 1995

CAS No.	Chemical	Class I Baseline	Class II Baseline
57-74-9	Chlordane	0.002	0.01
72-54-8	4,4'-DDD	0.00011*	0.00055
72-55-9	4,4'-DDE	0.00004*	0.0002
50-29-3	4,4'-DDT	0.00012*	0.0006
60-57-1	Dieldrin	0.00002*	0.0001
115-29-7	Endosulfan	0.042	0.042
72-20-8	Endrin	0.002	0.01
76-44-8	Heptachlor	0.0004	0.002
1024-57-3	Heptachlor epoxide	0.0002	0.001
118-74-1	Hexachlorobenzene	0.001	0.001
319-85-7	<i>beta</i> -BHC	No Data	No Data
58-89-9	Lindane (<i>gamma</i> -BHC)	0.0002	0.001
72-43-5	Methoxychlor	0.04	0.2
8001-35-2	Toxaphene	0.003	0.015
Polychlorinated Biphenyls			
1336-36-3	Polychlorinated Biphenyls (as Decachlorobiphenyl)	0.0005	0.0025

Chemical Abstracts Service (CAS) registry number. This number in the format xxx-xx-x, is unique for each chemical and allows efficient searching on computerized data bases.

*Acceptable Detection Limit - The standard groundwater numeric cleanup level is equal to ADL for carcinogens as specified in 35 III. Adm. Code 620, Subpart F. "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods," EPA Publication No. SW-846 and "Methods for the Determination of Organic Compounds in Drinking Water," EPA, EMSL, EPA-600/4-88/039, as incorporated by reference at Section 732.104 of this Part, must be used.

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Table B Soil Remediation Objectives^a

CAS No.	Chemical	Pathway-specific values for surface soils (mg/kg)		Migration to groundwater pathway levels (mg/kg)		ADLS
		Ingestion	Inhalation	Class I	Class II	
83-32-9	Acenaphthene	4,700 ^b	--- ^c	200 ^b	1,000	
67-64-1	Acetone	7,800 ^b	62,000 ^d	8 ^b	8	
309-00-2	Aldrin	0.04 ^a	0.5 ^a	0.005 ^a	0.025	
120-12-7	Anthracene	23,000 ^b	--- ^c	4,300 ^b	21,500	
71-43-2	Benzene	22 ^a	0.5 ^a	0.02	0.1	
56-55-3	Benzo(a)anthracene	0.9 ^a	--- ^c	0.7	3.5	
205-99-2	Benzo(b)fluoranthene	0.9 ^a	--- ^c	4	20	
207-08-9	Benzo(k)fluoroanthene	9 ^a	--- ^c	4	20	
50-32-8	Benzo(a)pyrene	0.09 ^{a,f}	--- ^c	4	40	
111-44-4	Bis(2-chlorethyl)ether	0.6 ^a	0.3 ^{a,f}	3E-4 ^{a,f}	3E-4	0.66
117-81-7	Bis(2-ethylhexyl)phthalate	46 ^a	210 ^d	11	110	
75-27-4	Bromodichloromethane (Dichlorobromomethane)	5 ^a	1,800 ^d	0.3	1.5	
75-25-2	Bromoform	81 ^a	46 ^a	0.5	0.5	
71-36-3	Butanol	7,800 ^b	9,700 ^d	8 ^b	8	

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CAS No.	Chemical	Ingestion	Inhalation	Class I	Class II	ADLS
85-68-7	Butyl benzyl phthalate	16,000 ^b	530 ^d	68	340	
86-74-8	Carbazole	32 ^a	--- ^c	0.2 ^{a,f}	1.0	
75-15-0	Carbon disulfide	7,800 ^b	11 ^b	14 ^b	70	
56-23-5	Carbon tetrachloride	5 ^a	0.2 ^a	0.03	0.15	
57-74-9	Chlorobenzene	1,600 ^b	94 ^b	0.6	3.0	
124-48-1	Chlorodibromomethane	8 ^a	1,900 ^d	0.2	1.0	
67-66-3	Chloroform	110 ^a	0.2 ^a	0.3	1.5	
218-01-9	Chrysene	88 ^a	--- ^c	1	5.0	
72-54-8 ¹	DDD	3 ^a	--- ^c	0.7 ^a	3.5	
72-55-9	DDE	2 ^a	--- ^c	0.5 ^a	2.5	
50-29-3	DDT	2 ^a	80 ^a	1 ^a	5.0	
53-70-3	Dibenzo(a,h)anthracene	0.09 ^{a,f}	--- ^c	11	55	
84-74-2	Di-n-butyl phthalate	7,800 ^b	100 ^d	120 ^b	600	
95-50-1	1,2-Dichlorobenzene(o)	7,000 ^b	300 ^d	6	15	
106-46-7	1,4-Dichlorobenzene (p)	27 ^a	7,700 ^b	1	5.0	
91-94-1	3,3-Dichlorobenzidine	1 ^a	--- ^c	0.01 ^{a,f}	0.05 ^{a,f}	1.3
75-34-3	1,1-Dichloroethane	7,800 ^b	980 ^b	11 ^b	55	
107-06-2	1,2-Dichloroethane	7 ^a	0.3 ^a	0.01 ^f	0.05	

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CAS No.	Chemical	Ingestion	Inhalation	Class I	Class II	ADLS
75-35-4	1,1-Dichloroethylene	1 ^a	0.04 ^a	0.03	0.15	
156-59-2	<i>cis</i> -1,2-Dichloroethylene	780 ^b	1,500 ^d	0.2	0.6	
156-60-5	<i>trans</i> -1,2-Dichloroethylene	1,600 ^b	3,600 ^d	0.3	1.5	
78-97-5	1,2-Dichloropropane	9 ^a	11 ^b	0.02	0.1	
542-75-6	1,3-Dichloropropene (1,3-Dichloropropylene, <i>cis</i> + <i>trans</i>)	4 ^a	0.1 ^a	0.001 ^{a,f}	0.005	0.005
60-57-1	Dieldrin ^a	0.04 ^a	2 ^a	0.001 ^{a,f}	0.005	0.0013
84-66-2	Diethyl phthalate	63,000 ^b	520 ^d	110 ^b	110	
131-11-3	Dimethyl phthalate	7.8E+5 ^b	1,600 ^d	1,200 ^b	1,200	
121-14-2	2,4-Dinitrotoluene	160 ^b	--- ^c	0.2 ^{b,f}	0.2	
606-20-2	2,6-Dinitrotoluene	78 ^b	--- ^c	0.1 ^{b,f}	0.1	
117-84-0	Di- <i>n</i> -octyl phthalate	1,600 ^b	--- ^e	--- ^g	--- ^g	
115-29-7	Endosulfan	470 ^b	--- ^c	4 ^b	4	
72-20-8	Endrin	23 ^b	--- ^e	0.4	2.0	
100-41-4	Ethylbenzene	7,800 ^b	260 ^d	5	7	
206-44-0	Fluoranthene	3,100 ^b	--- ^c	980 ^b	4,900	
86-73-7	Fluorene	3,100 ^b	--- ^c	160 ^b	800	
76-44-8	Heptachlor	0.1 ^a	0.3 ^a	0.06	0.3	

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CAS No.	Chemical	Ingestion	Inhalation	Class I	Class II	ADLS
1024-57-3	Heptachlor epoxide	0.07 ^a	1 ^a	0.03	0.15	0.056
118-74-1	Hexachlorobenzene	0.4 ^a	1 ^a	0.8	8	
87-68-3	Hexachloro-1,3-butadiene	8 ^a	1 ^a	0.1 ^f	0.5	
319-84-6	<i>alpha</i> -HCH (<i>alpha</i> -BHC)	0.1 ^a	0.9 ^a	4E-4 ^{a,f}	0.002	0.002
319-85-7	<i>beta</i> -HCH (<i>beta</i> -BHC)	0.4 ^a	16 ^a	0.002 ^a	0.01	0.004
58-89-9	<i>gamma</i> -HCH (Lindane) ^a	0.5 ^a	--- ^c	0.006	0.03	
77-47-4	Hexachlorocyclopentadiene	550 ^b	2 ^b	10	100	
67-72-1	Hexachloroethane	46 ^a	49 ^a	0.2 ^{a,f}	0.2	
193-39-5 ¹	Indeno(1,2,3- <i>c,d</i>)pyrene	0.9 ^a	--- ^c	35	175	
78-59-1	Isophorone	670 ^a	3,400 ^d	0.02 ^{a,f}	0.02	0.66
72-43-5	Methoxychlor	390 ^b	--- ^c	62	310	
74-83-9	Methyl bromide	110 ^b	2 ^b	0.1 ^b	0.1	
75-09-2	Methylene chloride	85 ^a	7 ^a	0.01 ^f	0.1	
91-20-3	Naphthalene	3,100 ^b	--- ^c	30 ^b	47	
98-95-3	Nitrobenzene	39 ^b	110 ^b	0.09 ^{a,f}	0.09	0.26
1336-36-3	Polychlorinated biphenyls (PCBs) ^a	1 ^b	--- ^{c,h}	--- ^b	--- ^b	
129-00-0	Pyrene	2,300 ^b	--- ^c	1,400 ^b	7,000	
100-42-5	Stryene	16,000 ^b	1,400 ^d	2	10	

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CAS No.	Chemical	Ingestion	Inhalation	Class I	Class II	ADLS
79-34-5	1,1,2,2-Tetrachloroethane	3 ^a	0.4 ^a	0.001 ^{a,f}	0.001	
127-18-4	Tetrachloroethylene	12 ^a	11 ^a	0.04	0.2	
108-88-3	Toluene	16,000 ^b	520 ^d	5	12.5	
8001-35-2	Toxaphene ^a	0.6 ^a	5 ^d	0.04 ^f	0.2	0.16
120-82-1	1,2,4-Trichlorobenzene	780 ^b	240 ^b	2	20	
71-55-6	1,1,1-Trichloroethane	--- ^e	980 ^d	0.9	4.5	
79-00-5	1,1,2-Trichloroethane	11 ^a	0.8 ^a	0.01 ^f	0.1	
79-01-6	Trichloroethylene	58 ^a	3 ^a	0.02	0.1	
108-05-4 ¹	Vinyl acetate	78,000 ^b	370 ^b	84 ^b	84	
75-01-4	Vinyl chloride	0.3 ^a	0.002 ^{a,f}	0.01 ^f	0.05	
1330-20-7	Xylenes (total)	1.6E+5 ^b	320 ^d	74	74	
	Ionizable Organics					
65-85-0	Benzoic Acid	3.1E+5 ^b	--- ^e	280 ^{b,i}	280	
106-47-8	<i>p</i> -Chloroaniline	310 ^b	--- ^e	0.3 ^{b,i}	0.3	1.3
95-57-8	2-Chlorophenol	390 ^b	53,000 ^d	2 ^{b,i}	2	
120-83-2	2,4-Dichlorophenol	240 ^b	--- ^e	0.5 ^{b,i}	0.5	
105-67-9	2,4-Dimethylphenol	1,600 ^b	--- ^e	3 ^{b,i}	3	
51-28-5	2,4-Dinitrophenol	160 ^b	--- ^e	0.1 ^{b,i}	0.1	3.3

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CAS No.	Chemical	Ingestion	Inhalation	Class I	Class II	ADLS
95-48-7	2-Methylphenol	3,900 ^b	--- ^c	6 ^{b,1}	6	
86-30-6	N-Nitrosodiphenylamine	130 ^c	--- ^c	0.2 ^{a,1,1}	0.2	0.66
621-64-7	N-Nitrosodi-n-propylamine	0.09 ^{a,1}	--- ^a	2E-5 ^{a,1,1}	2E-5	0.66
87-86-5	Pentachlorophenol	3 ^{a,1}	47 ^d	0.01 ^{1,1}	0.05	2.4
108-95-2	Phenol	47,000 ^b	--- ^c	49 ^{b,1}	49	
95-95-4	2,4,5-Trichlorophenol	7,800 ^b	--- ^a	120 ^{b,1}	600	
88-06-2	2,4,6 Trichlorophenol	58 ^a	210 ^a	0.06 ^{a,1,1}	0.06	0.43
	Inorganics					
7440-36-0 ¹	Antimony	31 ^b	--- ^c	0.004 ^b	0.024	
7440-38-2	Arsenic ^{a,1}	0.4 ^a	380 ^a	0.05 ^a	0.2 ^a	
7440-39-3	Barium	5,500 ^b	3.5E+5 ^b	2.0 ^a	2.0 ^a	
7440-41-7	Beryllium	0.1 ^a	690 ^a	0.006 ^a	---	
7440-43-9	Cadmium ^{a,1}	39 ^b	920 ^a	0.005 ^a	0.05 ^a	
7440-47-3	Chromium	---	---	0.1 ^a	1.0 ^a	
18540-29-9	Chromium, ion, hexavalent	390 ^b	140 ^a	---	---	
7439-92-1	Lead	400 ¹	--- ^c	0.0075 ^a	0.1 ^a	
7439-97-6	Mercury ^{a,1}	23 ^b	7 ^{b,1}	0.002 ^a	0.01 ^a	
7440-02-0	Nickel ^a	1,600 ^b	6,900 ^a	0.1 ¹	2.0 ^a	

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CAS No.	Chemical	Ingestion	Inhalation	Class I	Class II	ADLS
7782-49-2	Selenium ^a	390 ^b	--- ^c	0.05°	0.05°	
7440-22-4	Silver	390 ^b	--- ^c	0.05°	—	
7440-28-0	Thallium	--- ^c	--- ^c	0.002°	0.02°	
7440-62-2	Vanadium	550 ^b	--- ^c	--- ^k	--- ^k	
7440-66-6	Zinc ^m	23,000 ^b	--- ^c	5.0°	10°	
57-12-5	Cyanide	1,600 ^b	--- ^c	0.2°	0.6°	

Chemical Abstracts Service (CAS) registry number. This number in the format xxx-xx-x, is unique for each chemical and allows efficient searching on computerized data bases.

ADLs = Acceptable Detection Limit = is the detectable concentration of a substance which is equal to the lowest appropriate PQL or EQL specified in "Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods," EPA Publication No. SW-846 and "Methods for the Determination of Organic Compounds in Drinking Water," EPA, EMSL, EPA-600/4-88/039, as incorporated by reference at Section 859.103 of this Part must be used. For parameters where the specified objective is below the ADL, the ADL shall serve as the objective until the USEPA promulgates lower ADLs. When promulgated, the new USEPA ADL or the specified objective, whichever is higher, shall apply. For other parameters the ADL must be equal to or below the specified cleanup objective.

^aSoil remediation objectives based on human health criteria only.

^bCalculated values correspond to a noncancer hazard quotient of 1

^cNo toxicity criteria available for that route of exposure.

^dSoil saturation concentration (C_{sw}).

^eCalculated values correspond to a cancer risk level of 1 in 1,000,000.

^fLevel is at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).

^gChemical-specific properties are such that this pathway is not of concern at any soil contaminant concentration.

^hA preliminary goal of 1 ppm has been set for PCBs based on *Guidance on Remedial Actions for Superfund Sites with PCB Contamination*, EPA/540G-90/007, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C., 1990, and on Agency-side efforts to manage PCB contamination.

ⁱSoil remediation objective for pH of 6.8. If soil pH is other than 6.8, refer to Table C.

^jIngestion soil remediation objective adjusted by a factor of 0.5 to account for dermal exposure.

^kSoil/water partition coefficients not available at this time

^lA preliminary remediation goal of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER Directive #9355 4-12, Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C., July 14, 1994.

^mPotential for soil-plant-human exposure.

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"Sec 40 CFR 761.120, as incorporated by reference at Section 859.103 for USEPA "PCB Spill Cleanup Policy."
"Concentration in mg/l determined by the Method 1311 Toxicity Characteristic Leaching Procedure (TCLP) at 40 CFR 261, Appendix II, as incorporated by reference at Section 859.103 of this Part. Program participant has option to use TCLP objectives listed in this Table B or the pH specific soil remediation objective listed in Table C. If program participant wishes to calculate soil remediation objectives based on background concentrations, this should be done in consultation with the Agency.
"Value is for total chromium.
"The Agency reserves the right to evaluate the potential for remaining contaminant concentrations to pose significant threats to crops, livestock, or wildlife.

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Table C* pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics (mg/kg) for Protection of Class I Groundwater

Chemical (totals)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Arsenic	12	13	13	14	15	15	15	16	16
Barium	12	16	19	21	26	32	35	87	340
Beryllium	0.06	0.15	0.75	6	50	142	429	2,830	17,870
Cadmium	0.04	0.06	0.1	0.3	2	6	13	63	230
Chromium (+6)	36	31	27	24	20	19	18	16	14
Mercury	0.004	0.008	0.025	0.15	1	3	3	4	4
Nickel	0.9	1	2	3	11	20	32	71	115
Selenium	12	9	6	4	3	3	2	2	1
Thallium	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.5
Zinc	73	101	209	899	6,305	17,750	47,760	250,600	792,500
Benzoic Acid	63	59	57	57	56	56	56	56	56
2,4-Dichlorophenol	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.09	0.07
Pentachlorophenol	0.25	0.2	0.06	0.03	0.02	0.01	0.01	0.01	0.01
2,4,5- Trichlorophenol	35	35	34	33	26	22	17	9	5
2,4,6- Trichlorophenol	0.16	0.14	0.12	0.10	0.06	0.05	0.04	0.03	0.01

*If soil pH is less than 4.5 or greater than 8.0, this table cannot be used.

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Table D* pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics (mg/kg) for Protection of Class II Groundwater

Chemical (totals)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Arsenic	48	52	52	56	60	60	60	64	64
Barium	12	16	19	21	26	32	35	87	340
Beryllium	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Cadmium	0.4	0.6	1	3	20	60	130	630	2,300
Chromium (+6)	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Mercury	0.02	0.04	0.12	0.75	5	15	15	20	20
Nickel	18	20	40	60	220	400	640	1,420	2,300
Selenium	12	9	6	4	3	3	2	2	1
Thallium	2	2	3	3	3	3	4	4	5
Zinc	146	202	418	1,798	12,610	35,500	95,520	501,200	1,000,000
Benzoic Acid	63	59	57	57	56	56	56	56	56
2,4-Dichlorophenol	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.09	0.07
Pentachlorophenol	1.25	1.0	0.3	0.15	0.1	0.05	0.05	0.05	0.05
2,4,5-Trichlorophenol	175	175	170	165	130	110	85	45	25
2,4,6-Trichlorophenol	0.16	0.14	0.12	0.10	0.06	0.05	0.04	0.03	0.01

*If soil pH is less than 4.5 or greater than 8.0, this table cannot be used.

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Section 859. Appendix A

Illustration A

Equation for Ingestion of Noncarcinogenic Contaminants in Residential Soil

Soil Remediation Objective (mg/kg) = $\frac{THQ \times BW \times AT \times 365 \text{ d/yr}}{1 / RfD_o \times 10^{-6} \text{ kg/mg} \times EF \times ED \times IR}$	
Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
BW/body weight (kg)	15
AT/averaging time (yr)	6*
RfD _o /oral reference dose (mg/kg-d)	chemical-specific
EF/exposure frequency (d/yr)	350
ED/exposure duration (yr)	6
IR/soil ingestion rate (mg/d)	200

*For noncarcinogens, averaging time is equal to exposure duration.

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Section 859. Appendix A

Illustration B

Equation for Ingestion of Carcinogenic Contaminants in Residential Soil

Soil Remediation Objective (mg/kg) = $\frac{TR \times AT \times 365 \text{ d/yr}}{SF_o \times 10^{-6} \text{ kg/mg} \times EF \times IF_{\text{soil/adj}}}$	
Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10 ⁻⁶
AT/averaging time (yr)	70
SF _o /oral slope factor (mg/kg-d) ⁻¹	chemical-specific
EF/exposure frequency (d/yr)	350
IF _{soil/adj} /age-adjusted soil ingestion factor (mg-yr/kg-d)	114

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Section 859. Appendix A

Illustration C

Equation for Inhalation of Carcinogenic Contaminants in Residential Soil

<p>Soil Remediation Objective (mg/kg) =</p> $\frac{TR \times AT \times 365 \text{ d/yr}}{URF \times 1000 \mu\text{g/mg} \times EF \times ED \times \left[\frac{1}{VF} + \frac{1}{PEF} \right]}$	
Parameter/Definition (units)	Default
TR/target cancer risk (unitless)	10 ⁻⁶
AT/averaging time (yr)	70
URF/inhalation unit risk factor (μg/m ³) ⁻¹	chemical-specific
EF/exposure frequency (d/yr)	350
ED/exposure duration (yr)	30
VF/soil-to-air volatilization factor (m ³ /kg)	chemical-specific (see Illustration E)
PEF/particulate emission factor (m ³ /kg)	6.79 x 10 ⁸

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Section 859.Appendix A

Illustration D

Equation for Inhalation of Noncarcinogenic Contaminants in Residential Soil

Soil Remediation Objective (mg/kg) =	
$\frac{THQ \times AT \times 365 d/yr}{EF \times ED \times \left[\frac{1}{RfC} \times \left(\frac{1}{VF} + \frac{1}{PEF} \right) \right]}$	
Parameter/Definition (units)	Default
THQ/target hazard quotient (unitless)	1
AT/averaging time (yr)	30
EF/exposure frequency (d/yr)	350
ED/exposure duration (yr)	30
RfC/inhalation reference concentration (mg/m ³)	chemical-specific
VF/soil-to-air volatilization factor (m ³ /kg)	chemical-specific (see Illustration E)
PEF/particulate emission factor (m ³ /kg)	6.79 x 10 ⁸

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Section 859. Appendix A

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Illustration E*

Equation for Derivation of the Volatization Factor

$$VF(m^3/kg) = Q/C \times \frac{(3.14 \times \alpha \times T)^{1/2}}{2 \times D_{ef} \times \theta_a \times K_{as}} \times 10^{-4} m^2/cm^2$$

where

$$\alpha = \frac{D_{ef} \times \theta_a}{\theta_a + (\rho_s)(1 - \theta_a) / K_{as}}$$

Parameter/Definition (units)	Default
VF/volatization factor (m ³ /kg)	—
Q/C/Inverse of the mean conc. at the center of a 30-acre-square source (g/m ² -s per kg/m ³)	35.10
T/exposure interval (s)	9.5 x 10 ⁴ s
D _{ef} /effective diffusivity (cm ² /s)	D _i (θ _a ^{1.33} /n ²)
θ _a /air-filled soil porosity (L _{air} /L _{soil})	0.28 or n-wρ _s
D _i /diffusivity in air (cm ² /s)	chemical-specific ^b
n/total soil porosity (L _{por} /L _{soil})	0.43(loam)
w/average soil moisture content (g _{water} /g _{soil})	0.1 (10%)
ρ _s /dry soil bulk density (g/cm ³)	1.5 or (1 - n)ρ _s
ρ _s /soil particle density (g/cm ³)	2.65
K _{aw} /soil-air partition coefficient (g-soil/cm ³ -air)	(H'/K _d)
H/Henry's law constant (atm-m ³ /mol)	chemical-specific ^b
H'/Henry's law constant (unitless)	chemical-specific ^b ; H x 41 (where 41 is a conversion factor)
K _{oc} /soil-water partition coefficient (cm ³ /g)	K _{oc} x f _{oc}
K _{oc} /organic carbon partition coefficient (cm ³ /g)	chemical-specific ^b
f _{oc} /organic carbon content of soil (g/g)	0.006 (0.6%)

*If site-specific data are to be used instead of default values for soil-specific parameters (f_{oc}, θ_a, ρ_s, n, ρ_s, θ_a), all soil-specific parameters must be measured.

^bValues from Appendix C must be used or alternatives justified as being more appropriate may be used.

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Illustration F

Equation for Derivation of the Soil Saturation Limit

$C_{sat} = \frac{S}{\rho_b} (K_d \rho_b + \theta_w + H' \theta_a)$	
Parameter/Definition (units)	Default
C_{sat} /soil saturation concentration (mg/kg)	—
S/solubility in water (mg/L-water)	chemical-specific ^b
ρ_b /dry soil bulk density (kg/L)	1.5 or $\rho_s(1 - n)$
n/total soil porosity (L_{pore}/L_{soil})	0.43 (loam)
ρ_s /soil particle density (kg/L)	2.65
K_d /soil-water partition coefficient (L/kg)	$K_{ow} \times f_{oc}$ (organics)
K_{ow} /soil organic carbon/water partition coefficient (L/kg)	chemical-specific ^b
f_{oc} /fraction organic carbon of soil (g/g)	0.006 (0.6%)
θ_w /water-filled soil porosity (L_{water}/L_{soil})	$w \rho_b$ or 0.15
θ_a /air-filled soil porosity (L_{air}/L_{soil})	$n - w \rho_b$ or 0.28
w/average soil moisture content (g_{water}/g_{soil})	10% or 0.1
H'/Henry's law constant (unitless)	chemical-specific ^b , $H \times 41$, where 41 is a conversion factor
H/Henry's law constant (atm-m ³ /mol)	chemical-specific

^aIf site-specific data are to be used instead of default values for soil-specific parameters (L_w , θ_w , w, ρ_b , n, ρ_s , θ_a), all soil-specific parameters must be measured.

^bValues from Appendix C must be used or alternatives justified as being more appropriate may be used.

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Section 859.Appendix A

Illustration G

Equation for Derivation of the Particulate Emission Factor

$PEF(m^3/kg) = Q/C \times \frac{3600s/h}{0.036 \times (1-V) \times (U_m/U_t)^3 \times F(x)}$	
Parameter/Definition (units)	Default
PEF/particulate emission factor (m ³ /kg)	6.79 x 10 ⁴
Q/C/inverse of the mean conc. at the center of a 30 acre-square source (g/m ² -s per kg/m ³)	46.84
V/fraction of vegetative cover (unitless)	0.5 (50%)
U _m /mean annual windspeed (m/s)	4.69
U _t /equivalent threshold value of windspeed at 7 m (m/s)	11.32
F(x)/function dependent on U _m /U _t derived using Cowherd (1985) (unitless)	0.194

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Section 859. Appendix A

Illustration H^a

Partitioning Equation for Migration to Groundwater

<p>Soil Remediation Objective (mg/kg) =</p> $C_w \left[K_d + \frac{(\theta_w + \theta_a H')}{\rho_b} \right]$	
Parameter/Definition	Default ^b
C_w /target soil leachate concentration (mg/L)	Appendix B Table A or 35 III. Adm. Code 620.410 x dilution factor
dilution factor (unitless)	10 (or see Illustration I)
K_d /soil-water partition coefficient (L/kg)	chemical-specific ^c , $K_{oc} \times f_{oc}$ for neutral organics
K_{oc} /soil organic carbon/water partition coefficient (L/kg)	chemical-specific ^c
f_{oc} /fraction organic carbon of soil (g/g)	0.002 (.2%)
θ_w /water-filled soil porosity (L_{water}/L_{soil})	0.3 or $w\rho_b$
w /average soil moisture content (kg[water]/kg[soil])	0.2 (20%)
ρ_b /dry soil bulk density (kg/L)	1.5 or $(1 - n)\rho_s$
n /soil porosity (L_{pore}/L_{soil})	0.43 (loam)
ρ_s /soil particle density (kg/L)	2.65
θ_a /air-filled soil porosity (L_{air}/L_{soil})	0.13 or $(n - \theta_w)$
H' /Henry's law constant (unitless)	chemical-specific ^c , $H \times 41$
H /Henry's law constant (atm-m ³ /mol)	chemical-specific

^aThis equation is most readily used for neutral organic chemicals. Site-specific soil remediation objectives with a dilution factor of 10 for ionizing organic chemicals and inorganic chemicals can be determined from Table C. If responsible party wishes to calculate soil remediation objectives for ionizing organic chemicals and inorganic chemicals, this should be done in consultation with the Agency.

^bIf site-specific data are to be used instead of default values for soil-specific parameters (f_{oc} , θ_w , w , ρ_b , n , ρ_s , θ_a), all soil-specific parameters must be measured.

^cValues from Appendix C must be used or alternatives justified as being more appropriate may be used.

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Illustration I

Equation for Derivation of Dilution Factor

Dilution Factor =

$$1 + \frac{K i d}{\eta I L}$$

Parameter/Definition (units)

dilution factor (unitless)

K/aquifer hydraulic conductivity (m/yr)

i/hydraulic gradient (m/m)

d/mixing zone depth (m) (see Illustration J)

I/infiltration rate (m/yr)*

L/source length parallel to groundwater flow (m)

η /effective porosity

*The Illinois climatic data suggests an infiltration rate of 0.3 meters per year.

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Section 859.Appendix A

Illustration J

Equation for Estimation of Mixing Zone Depth

$$d = (0.0112L^2)^{0.5} + d_a(1 - \exp[(-LI)/Kid_a])$$

Parameter/Definition (units)

d/mixing zone depth (m)

L/source length parallel to groundwater flow (m)

I/infiltration rate (m/yr)^a

K/aquifer hydraulic conductivity (m/yr)

d_a/aquifer thickness (m)^b

i/hydraulic gradient (m/m)

^aThe Illinois climatic data suggests an infiltration rate of 0.3 meters per year.

^bUnless aquifer thickness has been determined under Subpart C, regional or other information, such as pre-existing boring logs, should be used to determine aquifer thickness.

APPENDIX E

**DUWAL REPORT-PRECIPIATION EFFECTS
ON GROUNDWATER-WETLANDS**

EVENT-BASED AND SEASONAL PRECIPITATION EFFECTS ON
SHALLOW GROUND WATER-WETLANDS INTERACTIONS
NEAR LAKE CALUMET, SOUTHEAST CHICAGO, ILLINOIS

BY

KENNETH G. DUWAL
B.S., University of Illinois at Chicago, Chicago, 1989

THESIS

Submitted as partial fulfillment of the requirements
for the degree of Master of Science in Geological Sciences
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This thesis is dedicated to my fiancée, Deborah Homziak. Without her loving support, it would never have been accomplished.

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The research was conducted on property owned by Waste Management of North America, Inc. I thank them for granting me access to their property. I would also like to thank Graig Johnson of Waste Management for his input and for unlocking the entrance to the site anytime I requested.

KGD

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SUMMARY

The interactions between the shallow ground water and several ponds were studied on a privately owned wetland in conjunction with the Illinois State Water Survey as part of their research on the occurrence and quality of the shallow ground water resources in the Lake Calumet area. Since the 1860's, wetlands in the area (including the field site) have been gradually filled-in for industrial use. 37 single and nested piezometers, 3 water table monitoring wells, and 7 seepage meters were used to study the hydrology of the site. Water levels were measured over the 9 month period from September 1993 to June 1994. Seasonal and event-based precipitation was measured using recording rain gauges. Continuous data on water level fluctuations was obtained using two water level recorders.

In general, shallow ground water flow is to the west toward Lake Calumet in response to a low hydraulic gradient, with the ponds acting as flow-through ponds. The presence of a surface fill layer has raised the level of the water table above that of the ponds, causing the hydraulic gradient to increase and ephemeral vertical components in the flow to appear in areas where the water table meets the level of the surface water. Results of a water budget analysis suggest that the conductivity of the fill may be 2 orders of magnitude higher than that of the underlying deposits. Water table fluctuations correlate with precipitation, with a lag time associated with infiltration that varies according to the moisture content prior to the event. Water level recorder data suggest that different measurement intervals are needed to accurately model water level fluctuations. Seepage measurements indicate that precipitation controls temporal variations in the seepage rates between ponds. Spatial variations in one pond are due to a small, short-lived ground water flow reversal which occurs when the water table is higher. In other ponds, spatial variations correlate with the locations of springs due to the presence of macropore systems in the fill.

I. INTRODUCTION

A. Background

The interaction between local ground water systems and lakes has become very important in recent years, mainly due to the rising alarm over the declining quality and safety of public water resources. The movement of contaminated ground water into lakes and other reservoirs, or visa versa, can pose serious dangers to the health and welfare of humans, wildlife, and the environment. Lakes and other surface water bodies are used for many purposes, including drinking water, recreation activities, and irrigation. Because of the accessibility of surface waters to the public, contamination of these waters may affect large populations, especially in major urban areas.

In 1987, the Illinois State Water Survey, in conjunction with the Illinois Environmental Protection Agency, conducted a ground water quality investigation of the Silurian Dolomite Aquifer underlying the Lake Calumet area on the southeast side of Chicago, Illinois (Cravens and Zahn, 1990)(Figure 1). In 1990, a ground water investigation of the shallow aquifer in the area was begun. Information on the interaction between Lake Calumet and the shallow ground water is crucial to the investigation, since the quality of the ground water can affect the lake's quality, or vice versa.

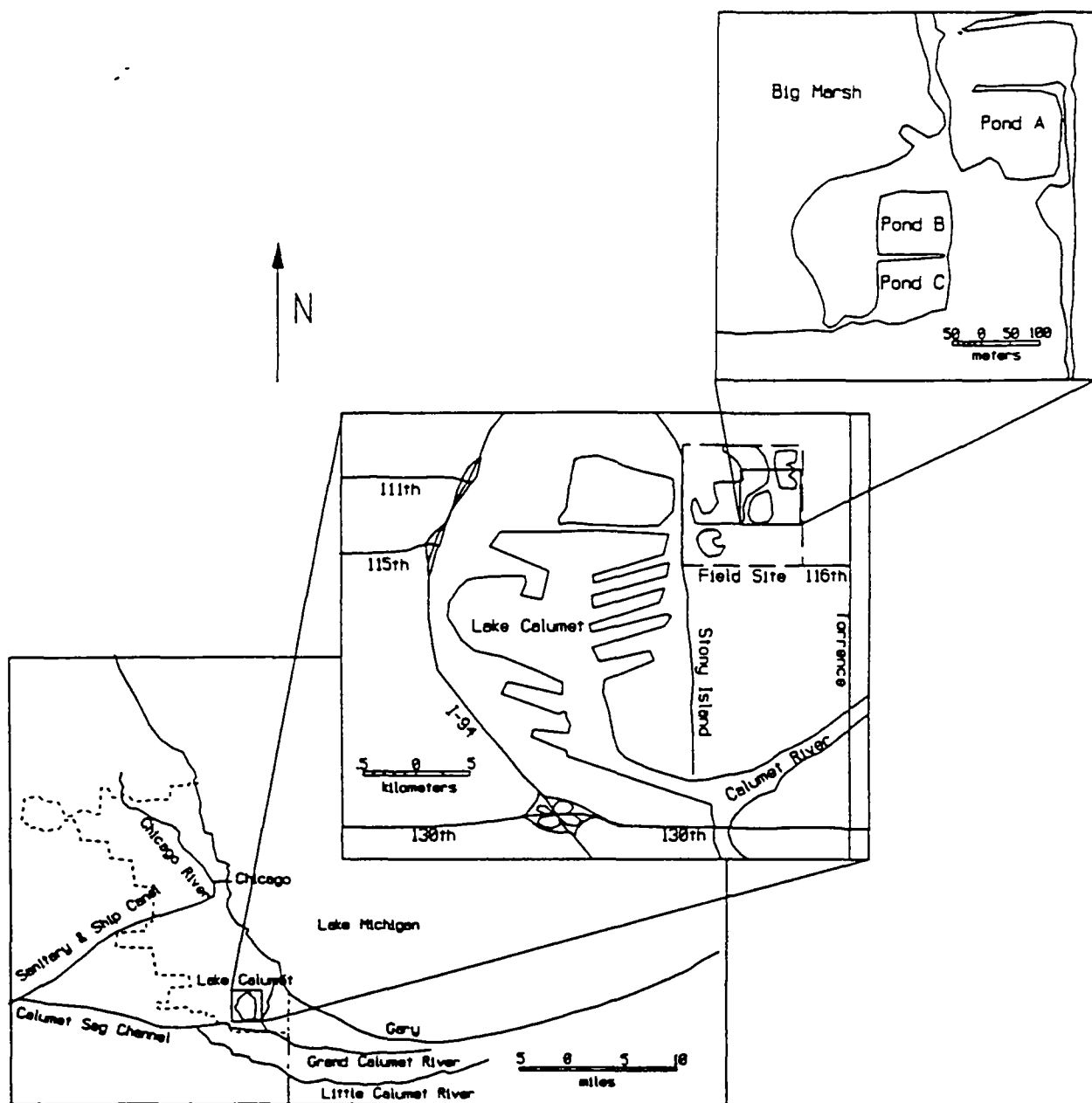


Figure 1. Location map of Lake Calumet and the field site.

B. Research Objectives

The main objective of this research is to understand a portion of the physical interaction between the shallow ground water and Lake Calumet by focusing on a small area of wetlands adjacent to the lake. The goal is to determine the nature of the shallow water table response to precipitation, both event-based and seasonal, and how this affects the rate at which water is added or taken out of the wetlands. This information will be useful in deciding how often ground water wells should be monitored and sampled in order to best describe the movement of contaminated water into and out of the Lake Calumet basin, and will also provide some insight into the possible flow paths available for solute transport within the system.

In many water quality investigations, sampling of ground water wells is performed at some regular interval, generally quarterly or semi-annually. This approach is useful for evaluating seasonal changes in water quality, but does not take into account changes in water chemistry which occur over small time scales, such as during specific precipitation events. A large percentage of the yearly total of a particular contaminant may enter a reservoir via the ground water during one large event, as opposed to some "average" amount being added throughout the year. Therefore, event-based monitoring of water table levels may provide many insights into the exchange of water and solutes between reservoirs and the shallow ground water.

Information on water levels, volume fluxes, and precipitation were collected using nested piezometers, seepage meters, and recording rain gauges during the nine month period from September 1993 to June 1994. Monitoring of the field equipment has yielded several time series data sets. A goal is to determine the extent to which the individual series are related to each other, i.e., how precipitation affects the level of the shallow water table, which in turn affects the rate and volume of water either placed into or taken out of the ponds. Understanding the

interrelationships of the individual components of the Lake Calumet-ground water system, at least in one small area of wetlands, will provide a basis for determining a monitoring and sampling plan for the entire lake, which is a main component of the shallow ground water quality investigation being performed by the Illinois State Water Survey.

II. PREVIOUS STUDIES OF LAKE-GROUND WATER INTERACTIONS

A relatively small amount of literature exists on the interactions between lakes and ground water systems, with most research being published in the past two decades. Specific studies are scarce, with only a handful of investigators contributing the bulk of the information, either through field studies or by performing numerical simulation studies.

Anderson and Munter (1981) used numerical modelling to verify field observations which indicated that the nature of the interaction between lakes and ground water can be affected by several factors. Seasonal changes in precipitation, and hence recharge to the ground water, caused mounding of the water table adjacent to Snake Lake in Wisconsin. The mound led to a reversal of the ground water flow around the lake, which changed the direction and amount of water flowing into or out of the lake. This flow reversal could dramatically alter the water budget of the lake. In fact, depending on the size and duration of a ground water mound, ground water may seep into a lake during one part of the year (classified as a discharge lake) and may leak from the lake during another (a recharge lake). Anderson and Munter found that the main causes of a ground water mound were high rates of recharge or areas of low hydraulic conductivity on the down gradient side of a lake, or when a lake is situated on a ground-water divide.

In a series of papers, Winter (1976, 1978, 1983) performed theoretical analyses using numerical simulation to show that the ground water flow field around lakes can be complex and affected by many factors, including topographic relief, depth to the water table, depth of the lake, recharge rates, and factors related to the simulation procedure, such as dimensionality. Winter (1983) showed that recharge to the ground water is variable in time and space. Variations in the thickness of the unsaturated zone causes infiltrating water to take longer paths to the water table, which may lead to the formation of local, complex flow systems and ground water

mounding, leading to changes in seepage to or from a lake. The mounds should first occur in places where the water table is closer to the surface, such as directly near lakes or beneath low points in the land surface. Recharge to the topographically higher areas away from a lake will occur through vertical infiltration combined with the redistribution of water associated with the hydraulic head of ground water mounds. The complex flow systems caused by local recharge may form and disappear quickly in permeable material, or may last months to years in less permeable porous media.

The findings of Winter (1983) have implications for the design of monitoring well systems. Instead of placing wells in the usual place, at the high point on the land surface, wells should be concentrated adjacent to a lake in order to define the early transient effects of the local recharge, i.e. ground water mounding.

Sacks et al. (1992) used a two dimensional solute-transport model to predict observed changes in flow directions and solute concentrations due to seasonal changes in precipitation in three hydraulically connected "flow through" lakes in Spain. A flow through lake is distinguished from a discharge or recharge one in that the lake discharges ground water on one side and recharges the ground water on the other. The researchers found that depending on the position of a particular lake in the regional flow system, seepage to the lake may occur from all sides during wet seasons, and from only certain areas during dry seasons. This behavior has a tremendous affect on the solute concentrations of a lake; solute flux into a lake may be large during wet seasons and small during dry seasons. Complex flow systems and solute fluxes can occur during prolonged wet or dry periods.

Confirmation of the validity of numerical simulations has been scarce. One such study was performed by Cherkauer and Zager (1989) on the exchange of water between ground water and the Lower Nashotah Lake in southeast Wisconsin. Piezometers and seepage meters were used to monitor the level of the shallow

water table over a period of time. The study concluded that the exchange of water was controlled by an ephemeral ground water mound which changed the direction and amount of seepage between the lake and ground water. The results confirmed the validity of the simulation studies of previous researchers, especially the findings of Winter (1976, 1978, 1983).

Quantifying the ground water contributions to the water budget of lakes was the objective of two papers published by Krabbenhoft et al. (1990a, 1990b). Two different methods were used independently on Sparkling Lake in northern Wisconsin: a stable isotope ($^{18}\text{O}/^{16}\text{O}$) mass balance method, and the calibration of a three-dimensional, solute transport model to a stable isotope plume. The theory behind the research was that due to the higher vapor pressure and diffusivity of the lighter isotopic species of water, H_2^{16}O , surface water bodies experiencing evaporation become enriched in the heavier species of water, H_2^{18}O , compared to the other components of the water budget. The isotopic signatures of each component can be readily measured. Since Sparkling Lake is located in permeable material and has no surface water entry or exit points, the calculation of the ground water contributions using mass balance equations was simplified. A finite difference solute transport model was then calibrated to the plume of isotopically heavier water which seeped from the lake. The model was used to also calculate the ground water contributions to the lake budget. Results of the individual methods compared very well, suggesting that the methods are useful in quantifying ground water fluxes.

The fact that the water table in wetlands is very close to the surface makes them ideal places to study ground water-surface water interactions. Research on wetlands in the Chicago area is very limited. One project was conducted by Hensel and Miller (1991) in which they studied the effects of artificially created wetlands on the ground water flow near the Des Plaines River in northeast Illinois. Four

experimental wetlands were created by pumping water from the river. Two of the wetlands were situated over sand and gravel; the other two were situated over clayey till. Water levels in nested piezometers were monitored monthly for two years, and a numerical model was calibrated using these values to estimate seepage from the wetlands into the Des Plaines River. Their research concluded that the wetlands acted as a constant head boundary due to pumping and that the wetlands rose the ground water levels in the immediate area by about 0.5 meter. The rise caused seepage into the Des Plaines River ranging from 1 m³/day for the wetlands situated over clayey till to 60-150 m³/day for those situated over sand and gravel.

A main limitation in the research conducted in the area of ground water-surface water interactions is in the period in which water level and precipitation measurements were taken. Measurements were generally taken on a monthly or bi-monthly basis. This may be satisfactory for determining seasonal precipitation effects, but as was stated earlier, fluctuations in water levels, and possibly contaminant fluxes, caused by precipitation on an event basis may be very important. Therefore, this current research has focused on the effects upon the interactions between wetlands and shallow ground water on both a seasonal and an individual event basis.

In addition, the previous research was conducted in areas in which the surface material had not been disturbed. In southeast Chicago, much of the surface layer consists of material used to fill in former wetlands. Scarce information exists on the effects which the fill material has had on the shallow ground water flow system. This current research has been conducted on filled-in wetlands and thus may provide needed information to gain some insight into the problem.

III. DESCRIPTION OF THE STUDY SITE

A. History of the Lake Calumet Area

1. Recent Geologic History

The recent geologic history of the Lake Calumet area is tied to the Pleistocene glacial history of the Chicago area and the formation of Lake Michigan. Information on the geologic history of the Chicago area has been documented by Bretz (1955) and Willman (1971). Summaries of this history have been presented in several environmental studies of the Calumet area, including Colten (1985), Ross et al. (1988), and Cravens and Zahn (1990).

Lake Calumet is located fifteen miles south of downtown Chicago (Figure 1) in a shallow depression formed approximately 13,500 years ago by Lake Chicago, the prehistoric lake formed by the meltwaters of receding glaciers of the Wisconsin Glaciation. A bedrock outcrop north of Lake Calumet, Stony Island, deflected water and coarse sediment which would have filled in the lake. Instead, the sediment which accumulated in the lake consisted of fine-grained silts, clays, and organic rich sediment. Glacial Lake Chicago eventually receded to become the present Lake Michigan. The area uncovered by the receding lake was a low, flat plain with poor drainage. Water left behind became Lake Calumet and associated wetlands.

The stratigraphy of the area consists of an average of 75 feet of glacial material covering Silurian dolomite bedrock. The glacial material consists of 15-40 feet of gray, silty clay belonging to the Wadsworth Till Member of the Wedron Formation, underlain by 10-60 feet of silt and gravel of the Lemont Drift. Overlying these till deposits are deposits of glacial Lake Chicago, consisting of generally less than 20 feet of silt and clay of the Carmi Member of the Equality Formation. Much of this surface material around Lake Calumet has been replaced and/or covered by material used to fill in sections of the lake for industrial purposes. In addition, glacial Lake

Chicago spits and bars comprised of sand of the Dolton Member of the Equality Formation can be found in the area.

2. Industrial History

Colten (1985) describes the industrial history of the Lake Calumet area. In 1869 the Army Corps of Engineers began to transform the Lake Calumet area into a protected inland harbor. By 1870, industries began filling in the wetlands and building along the shores of the lake and the area's rivers: the Calumet, the Little Calumet, and the Grand Calumet. The Calumet River directed the combined discharge of the lake and the other two rivers into Lake Michigan. To control the amount of industrial and municipal waste flowing into Lake Michigan, the flow of the Calumet River was diverted to the Mississippi River drainage basin in 1922.

For over a century, industries in the area have been producing primary metals and metal goods, industrial and agricultural chemicals, paints, and wood and grain products, and were discharging large amounts of wastes into the environment. Over the past decade, numerous studies of the affects of these wastes to the soil and water resources of the area have been performed by several agencies, including the Illinois Environmental Protection Agency, the Illinois State Water Survey, and the Illinois Department of Energy and Natural Resources. Several of these include Bhowmik and Fitzpatrick (1988), Ross et al. (1988), Shafer et al. (1988), and Fitzpatrick and Bhowmik (1990).

B. Field Site Land Use

The field site for this study is a 1.5 km² area of wetlands northeast of Lake Calumet which is bounded by Norfolk Southern railroad tracks on the north, 116th Street on the south, railroad tracks and the Acme Steel Coke Plant on the east, and Stony Island Avenue on the west (Figure 1). The site consists of wetlands and several ponds which drain into Lake Calumet via culverts. The ponds are separated by filled-in land. The site was once owned by Interlake Steel and was used to dump iron slag from the furnaces. It was purchased by Waste Management Inc. to become a landfill. Unfortunately, ground water seepage in an excavation in the northeast corner of the site forced the abandonment of the landfill plans (Craig Johnson pers. comm.). Waste Management Inc. now has plans to turn the site over to the State of Illinois to be converted into a state conservation area. Most of the field work during this research has been concentrated in an area in the northeast corner of the site (Figure 1).

Prior to industrial expansion in the region, the study site, as well as much of the Lake Calumet area, was wetlands. Much of the land was filled in for industrial use. The material used to fill in the areas was from different sources, including dredge spoils from the dredging of the Calumet River and Lake Calumet for navigation. The field site was one area filled in with dredge spoils. Over the years, iron slag from steel mill furnaces and construction debris was also used as fill on the site.

C. Site Lithology

In 1983, several soil borings were drilled in different areas of the site, and some of the borings were converted into shallow and deep monitoring wells. The data from the boring logs of four of the deep wells has been added to data from the boring logs from the installation of piezometers and monitoring wells during this field study in order to construct stratigraphic cross-sections of the site (Figure 2). Surface topography data was taken from a map of the site constructed in 1983 by Canonie Environmental. Since the time the map was made, the only variations in the site have been in the vegetation and in the water levels of the ponds.

From the cross-sections it can be seen that the top 2-3 meters of the site is composed of material identified as fill, which tends to be composed of steel mill slag and construction debris, such as concrete. Below the fill are silts and clays belonging to the Equality Formation. Underlying the Equality Formation are glacial tills of the Wadsworth Till member of the Wedron Formation which consist of poorly sorted clay, silt, sand, and gravel with occasional sand or silt layers. Below the glacial till is Silurian age dolomite which is dipping to the east at approximately 0.5 degree. This dolomite comprises the shallow bedrock aquifer in the Chicago area, and is under a confining pressure due to the presence of clay layers in the overlying glacial sediments. In the very northeast corner of the site, the depth to the dolomite decreases drastically (Figure 2, section SW-NE). The reason for the decrease is not clear. It is possible that it is an irregularity in the surface of the dolomite. A bedrock surface topography map for the Lake Calumet region (Cravens and Zahn, 1990) indicates that the bedrock surface is highly irregular and that the elevation rises in the area of the site.

In this investigation, it was found that the local shallow ground water flow domain is limited to the fill material and the upper 1-1.5 meters of the shallow aquifer.

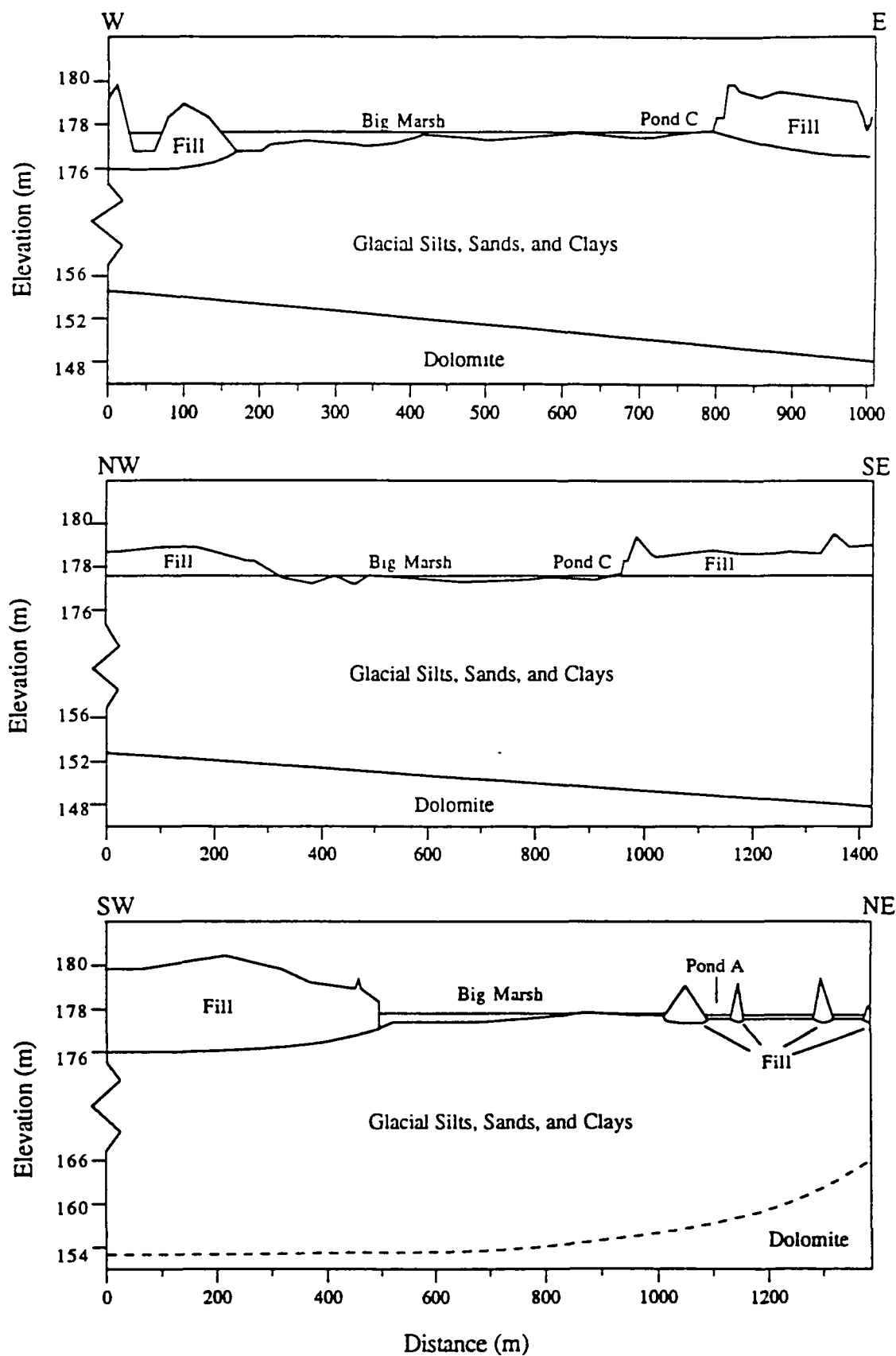


Figure 2. Stratigraphic cross-sections of the field site.

IV. FIELD METHODS

During the summer and early fall of 1993, instruments were installed in order to perform a hydrologic study of the site.

To monitor the shallow water table response to precipitation, a hierarchical network of single and nested piezometers was set-up on the site. Several shallow monitoring wells had been placed along the perimeter of the site in 1983. These existing wells were used for water levels on the perimeter of the area. The locations of the new piezometers were selected with the aid of the topographic map of the site constructed in 1983 by Canonie Environmental. Using a drill rig operated by the Illinois State Water Survey, 31 piezometers in 10 nests were placed in the area between the ponds to study the interactions between the individual ponds (Figure 3). All new piezometers were made of 3.4 centimeter inside diameter PVC pipe with slots drilled along the bottom. In addition, three monitoring wells were placed in the area. The wells were made of 5.1 centimeter inside diameter PVC pipe with a 0.61 meter slotted screen at the bottom.

For the piezometer nests, 20 centimeter diameter hollow stem augers were augered to approximately 3 meters below ground. Three piezometers of differing lengths (four in the case of nest #1) were taped together so that the tops of the casings were even and then placed inside the augers. The hole was then allowed to collapse as the augers were removed and the remaining space was backfilled.

The monitoring wells were placed in a 20 centimeter diameter borehole augered to 3 meters below ground. The depth to which the casing was inserted depended on the amount of caving in of the borehole after the augers were pulled from the hole. A filter pack of silica sand was added to approximately 0.3-0.6 meter above the top of the screen. A 0.6 meter clay seal of bentonite pellets was then added. The hole was then backfilled to the ground surface.

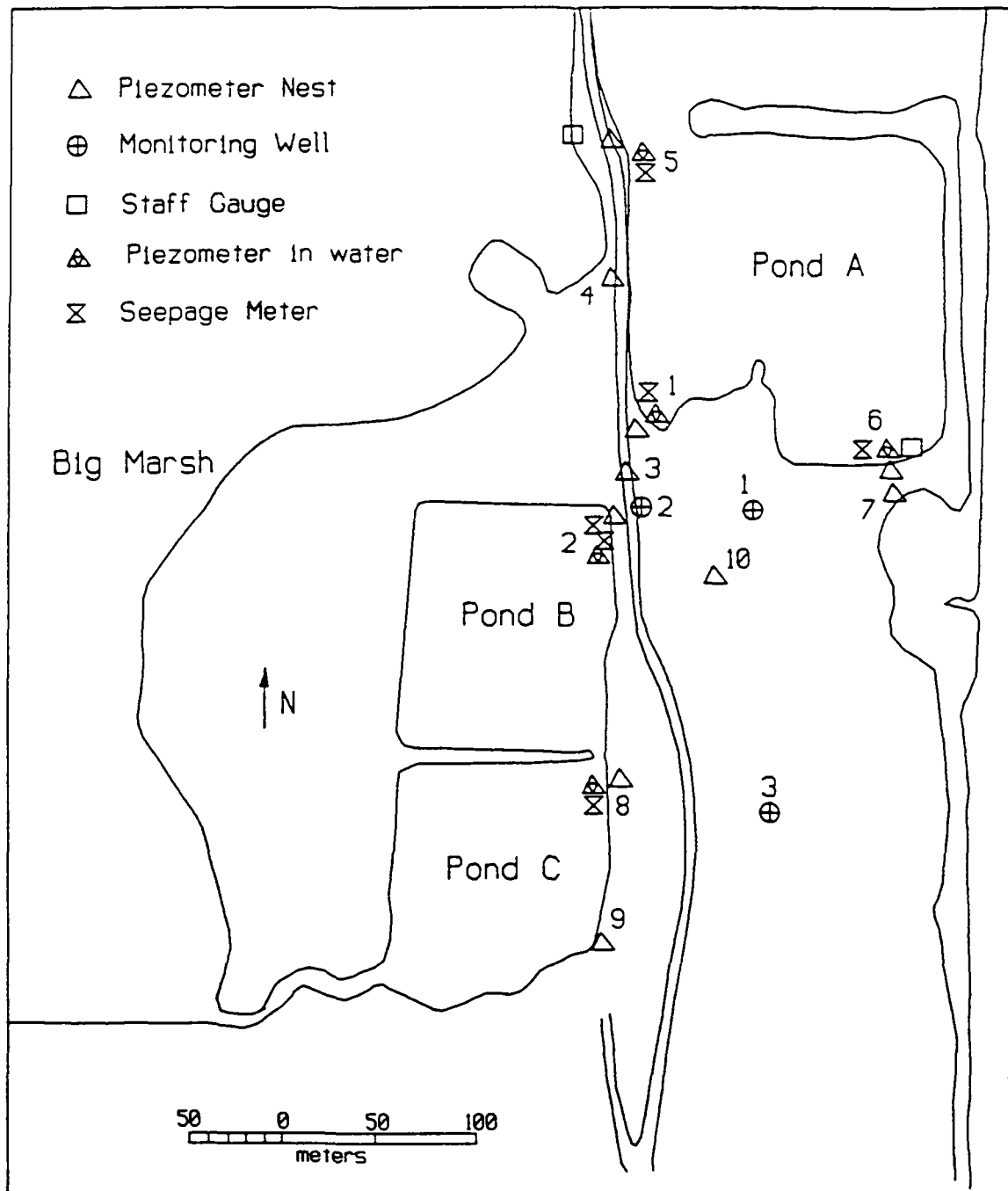


Figure 3. Site map showing the locations of the field equipment.

The positions of the piezometers and wells, along with their elevations, were surveyed to a known point taken from the existing site map using a Total Station surveying transit (Table 1).

To measure the seepage rate per time into and out of the ponds, seven seepage meters were placed in the shallow water near the banks (Figure 3). The seepage meters used are similar to the type described by Lee (1977) and Lee and Cherry (1978).

To measure the water level and the hydraulic head at depth in the ponds, three single and two sets of two nested smaller diameter piezometers were installed down to a depth of 0.3-1 m in the shallow water. The piezometers were made of 2.54 centimeter inner diameter PVC.

A staff gauge was used to monitor the level of the Big Marsh.

A recording rain gauge was set out to record hourly precipitation totals in order to assess the link between precipitation and water table fluctuations. Because of inaccuracies due to snowfall, the recording gauge was not used from the end of December until early March. During this interval, daily precipitation rates were obtained from an Illinois State Water Survey recorder set at Wolf Lake, approximately 5 kilometers southeast of the site.

A soil probe analysis of the lithology of the site down to the water table was considered for selected points along surveyed transects. Unfortunately, the surface material is mostly iron slag and other debris, restricting the penetration of the soil probe and necessitating the use of a drill rig to gain any stratigraphic information. Therefore, the idea was abandoned.

Monitoring of the field instruments took place on average once to twice weekly. In addition, one of the monitoring wells (MW-2) and a steel rod set in pond A were affixed with a pressure transducer to continuously record the water levels and average them every hour. During three precipitation events, another recording

rain gauge was set out to measure precipitation approximately every nine minutes, and the water level recorders were set to average the levels every ten minutes.

TABLE I
PIEZOMETER ELEVATIONS

Piezometer	Length of Piezometer (m)	Elevation of Casing Top (m)	Elevation of Casing Bottom (m)		
P-1A	3.05	179.003	175.953		
P-1B	2.59	178.99	176.4		
P-1C	1.55	178.978	177.428		
P-1D	1.98	178.981	177.001		
P-2A	3.05	178.96	175.91		
P-2B	2.44	178.953	176.513		
P-2C	1.98	178.948	176.968		
P-3A	3.05	179.695	176.645		
P-3B	2.44	179.69	177.25		
P-3C	1.98	179.693	177.713		
P-4A	3.05	179.52	176.47		
P-4B	2.44	179.503	177.063		
P-4C	1.98	179.503	177.523		
P-5A	3.05	179.211	176.161		
P-5B	2.44	179.212	176.772		
P-5C	1.98	179.216	177.236		
P-6A	3.05	179.674	176.624		
P-6B	2.44	179.666	177.226		
P-6C	1.98	179.669	177.689		
P-7A	3.05	179.604	176.554		
P-7B	2.44	179.605	177.165		
P-7C	1.98	179.603	177.623		
P-8A	3.05	179.25	176.2		
P-8B	2.45	179.25	176.8		
P-8C	1.99	179.24	177.25		
P-9A	3.05	179.517	176.467		
P-9B	2.44	179.519	177.079		
P-9C	1.98	179.514	177.534		
P-10A	3.05	179.955	176.905		
P-10B	2.44	179.955	177.515		
P-10C	1.98	179.953	177.973		
				Screen Top	Screen Bottom
MW-1	3.89	181.014	177.124	177.964	177.35
MW-2	3.89	180.025	176.135	176.975	176.37
MW-3	3.89	180.449	176.559	177.399	176.79
				Casing Top after Winter Freezing	
P-1W	1.04	178.818	177.778	178.926	
P-2WS	1.38	178.152	176.782	178.14	
P-2SD	1.57	178.157	176.597	178.15	
P-5W	1.12	178.928	177.808	178.956	
P-6W	1.6	178.748	177.148	178.856	
P-8W	2.08	178.155	176.075	178.155	

V. OBSERVATIONS AND RESULTS

A. Site Hydrology

1. Water Level Measurements

a. Determination of Mean Ground Water Flow Patterns

The elevation of the water table measured on an arbitrary day (December 3) from the piezometers, monitoring wells, and staff gauges were entered into a two-dimensional graphing program (DeltaGraph Professional) which produced a contour map of the water table (Figure 4). On June 9, 1994, a Global Positioning System (GPS) survey was performed on the site. The data from the survey was combined with data on the water levels in the four shallow wells existing on the site and from the piezometers to produce a contour map of the shallow water table of the entire site (Figure 5). The assumptions of steady state conditions and a homogeneous and isotropic aquifer were made in producing the maps. Although the distribution of hydraulic head is true, the system is in a transient state, with vertical hydraulic gradients existing which are not shown on the map. This prohibits the inference of absolute flow directions; only generalizations can be made. In addition, the aquifer may not be homogeneous or isotropic due to the chaotic nature of the surface fill material. Nevertheless, making these assumptions facilitates the contouring process and produces a working estimate of the surface of the water table.

From the water table maps, it can be seen that shallow ground water flow in the study area is generally to the west, toward the Big Marsh and eventually toward Lake Calumet. This implies that the ponds are "flow through" ponds, acting as discharge points for ground water along their eastern borders, and as recharge points along their western borders.

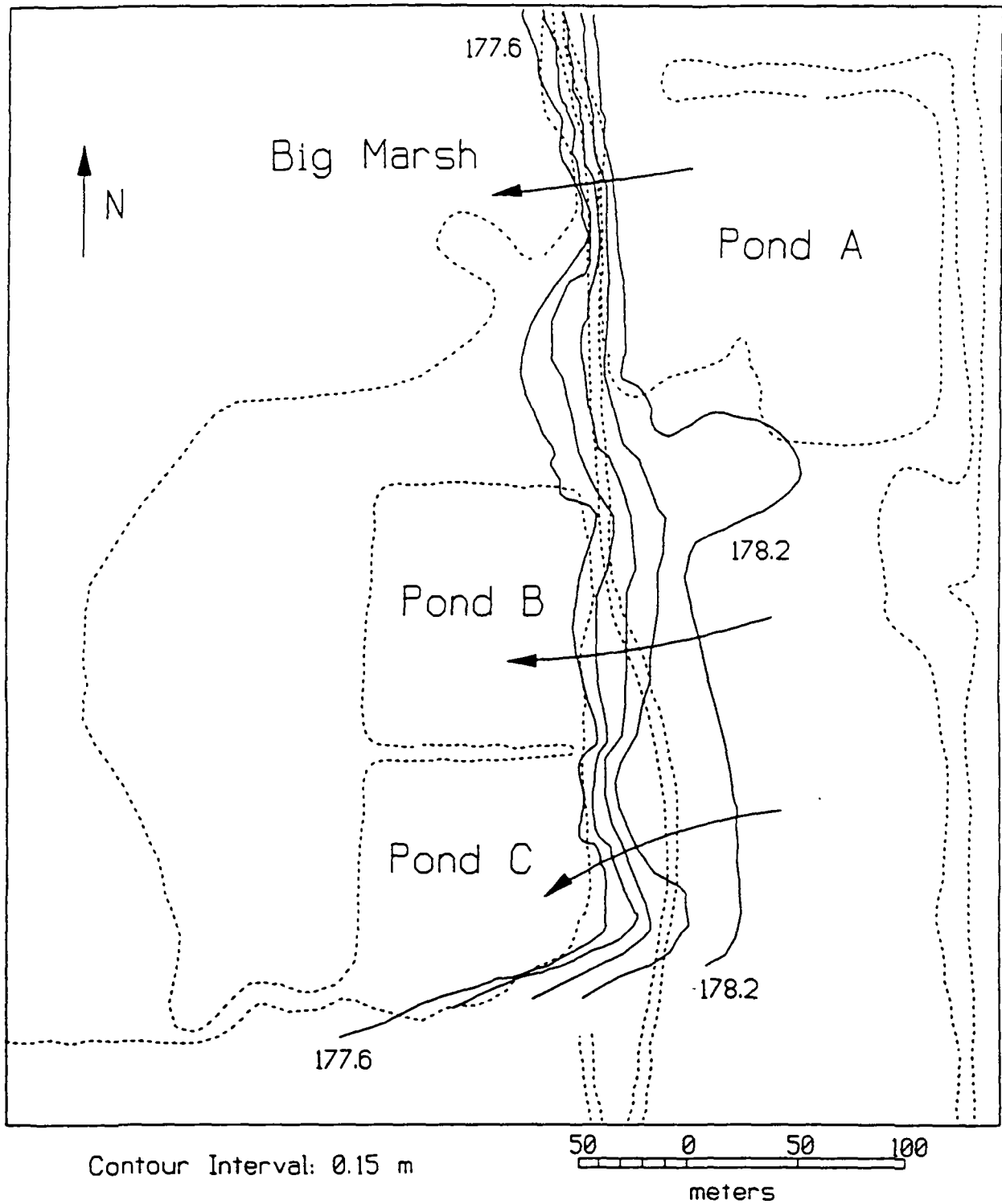


Figure 4. Water table contour map for December 3, 1993.

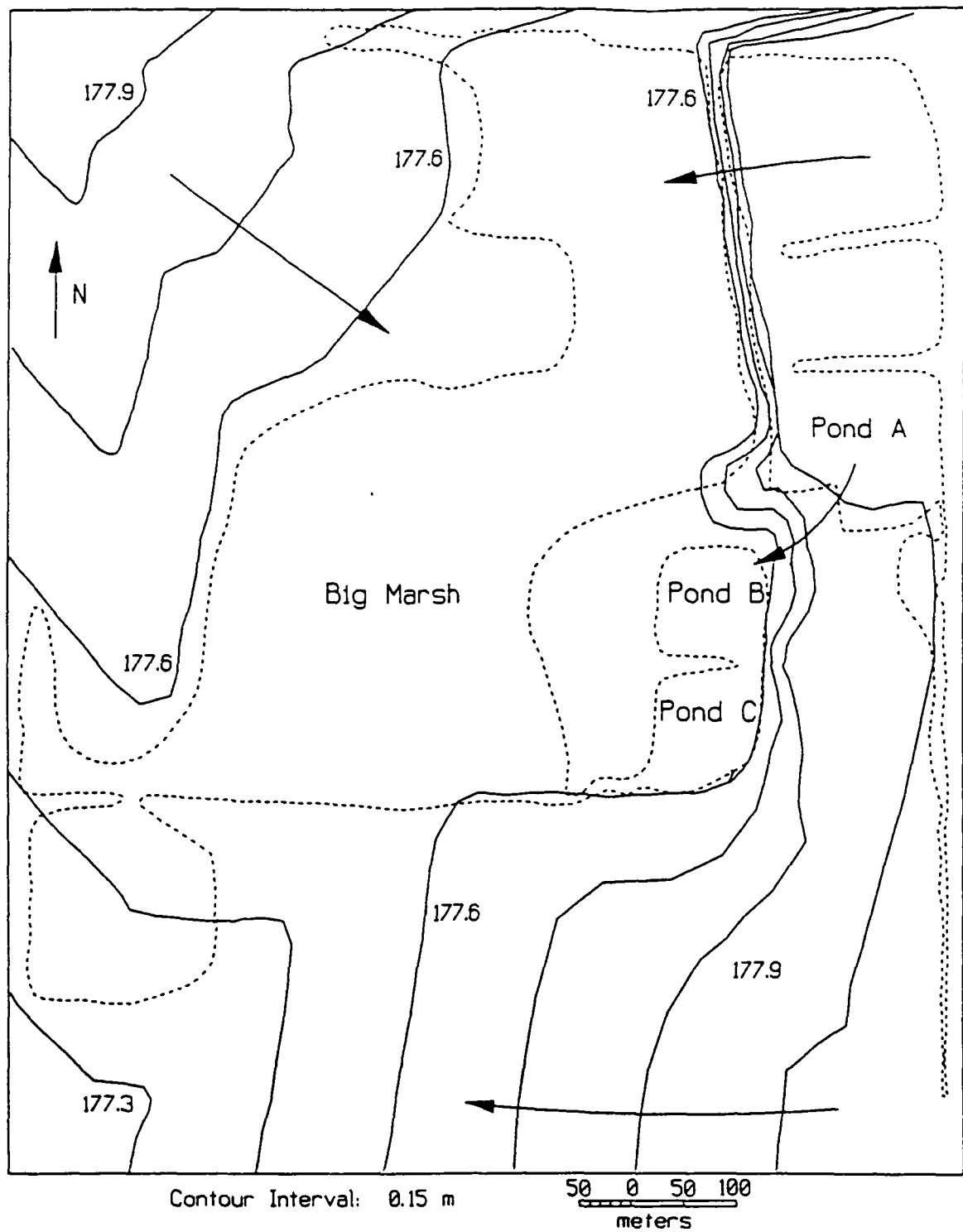


Figure 5. Water table contour map of the entire site for June 9, 1994.

Field observations support the general flow to the west as inferred from the maps, including: 1) the decreasing elevations of the water table measured in the ponds and piezometers in the west direction, 2) the presence of springs in ponds B and C (indicating that ground water is discharging into these ponds), and 3) the decrease in the clarity and increase in odor of the water in the west direction, indicating that the ground water dissolves minerals as it flows through the fill material (especially the iron slag), which re-precipitate when the water discharges into ponds B and C. These re-precipitated minerals appear as a layer of white scum observed on the surface of the ponds, especially after precipitation events.

The maps also indicate that hydraulic gradients between the ponds vary spatially. The spatial variability is a function of the amount of "land" separating the ponds. Between pond A and the Big Marsh, the strip of land separating them is roughly 20 meters wide, whereas the elevation difference between the two ponds averages 60 cm. Therefore, the hydraulic gradient in the area is high, averaging 3 cm/m. Near piezometer nests P-8 and P-9, the amount of land separating surface water bodies is much greater, allowing the hydraulic gradient to remain lower, averaging 1 cm/m. However, along the eastern borders of ponds B and C near the piezometer nests, the land surface drops quickly to the surface of the ponds, forcing the gradient to increase to 3-4 cm/m. The surface dropoff also causes vertical hydraulic gradients to appear in the area.

The hydraulic gradient in the area between ponds A and B is also dependent on the elevation difference between the two ponds. The surface topography of the land separating the ponds is highest in the middle and slopes down to the ponds on either side (Figure 6a). Since the surface of the water table under a hill has been shown to be a subdued version of the hill, a ground water mound was suspected to exist in the area. Piezometer nest P-3 was installed between the ponds on higher ground in order to determine if a mound was present. Figures 6 indicates the

presence of a vertical hydraulic gradient (discussed later)(Figure 6b), but not a ground water mound in the area of nest P-3. The absence of a mound may be due to a high hydraulic conductivity of the surface material.

The water table maps also indicate a slight mounding of the ground water in the area between ponds B and C. The water in the area near nest P-8 flows predominantly toward pond C, but also diverges slightly toward nests P-2 and P-9. The history of the ponds may explain the presence of the mound. The ponds were formed when the Big Marsh was filled-in. A strip of fill now separates the two ponds. This artificial hill may cause the water table under it to be higher than the adjacent ponds. Piezometer nest P-8 is located in the area between the ponds, and thus should record the presence of the mounding.

Figure 7 shows the water level in the shallowest piezometers of nests P-2, P-8, and P-9, which are located along the eastern borders of ponds B and C. The figure indicates that the level in P-8 is the highest of the three. This indicates that mounding does occur near nest P-8, causing hydraulic gradients to exist from nest P-8 toward nests P-2 and P-9.

Another cause of the mounding near nest P-8 may be due to the existence and location of springs along the eastern border of ponds B and C, which may influence the magnitude of the hydraulic gradient. This idea will be discussed later in the section on vertical hydraulic gradients.

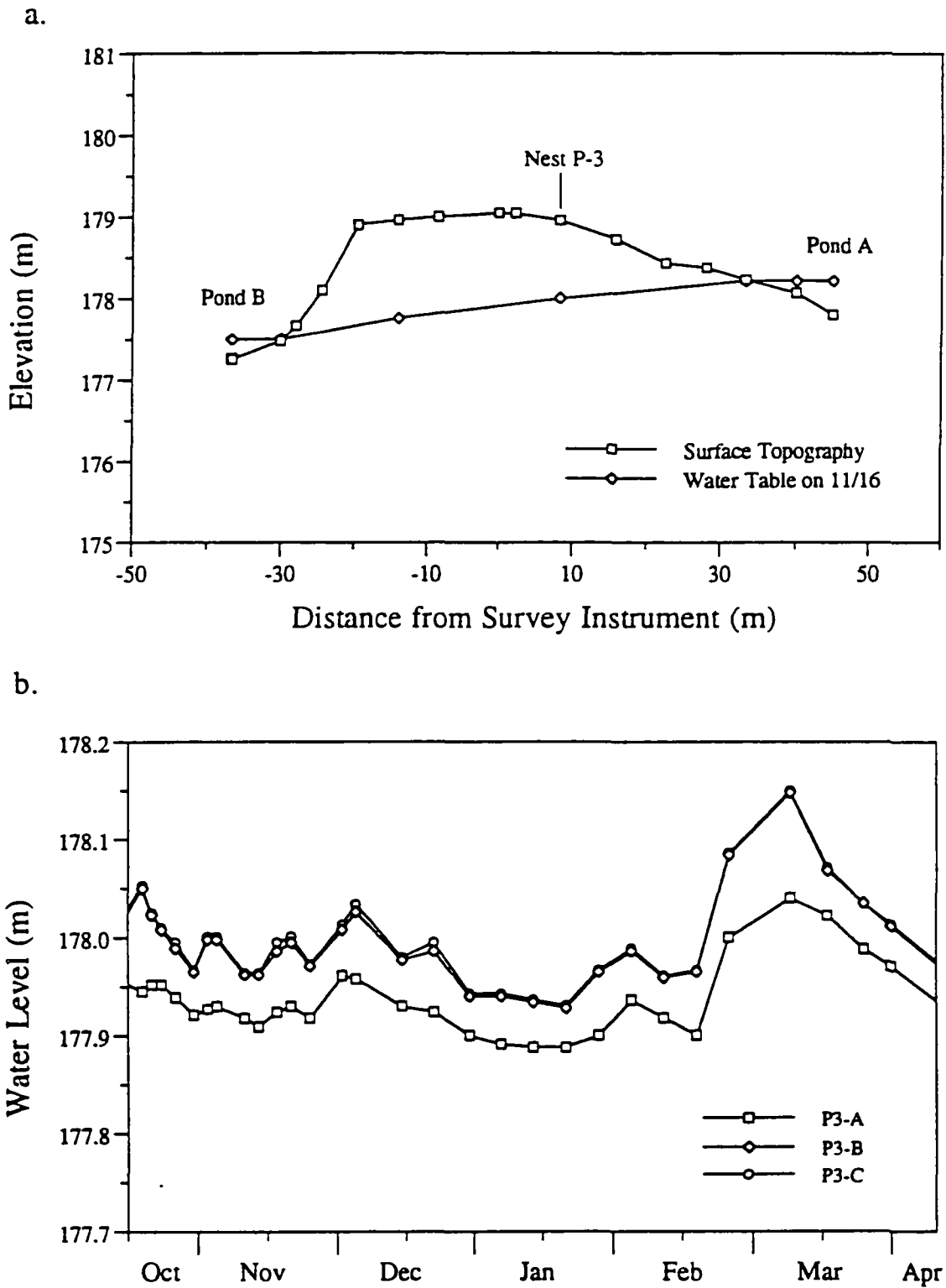


Figure 6. a. Water table cross-section from pond A to pond B on 11/16/94.
b. Measured water levels in piezometer nest P-3.

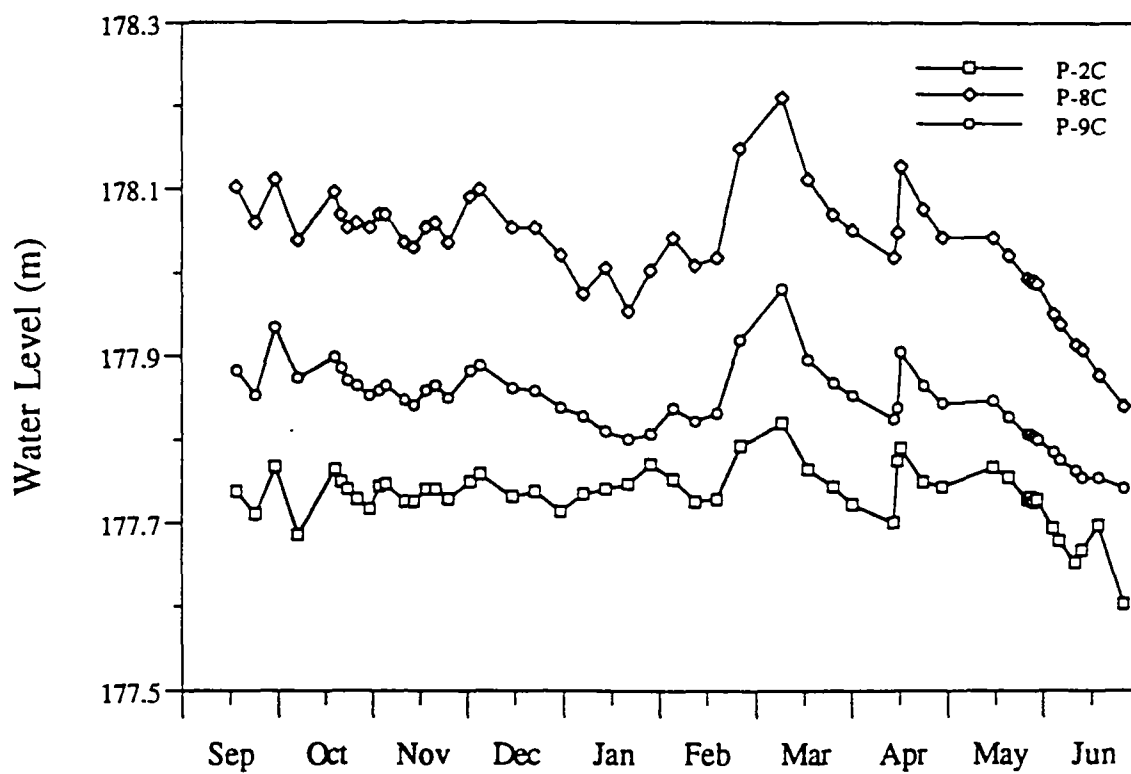


Figure 7. Measured water levels in piezometers P-2C, P-8C, and P-9C.

b. Cross-Sections of the Water Table

Using data from straight line surveys and water level measurements, six topographic and water table cross-sections have been made, four E-W sections, one N-S section, and one SW-NE section (Figure 8). The cross-sections show that the gradient of the water table is relatively low from the eastern border of the site to near ponds B and C, and increases rapidly just before the ponds (note sections D-D' and E-E'). The rate of increase is related to the surface topography near the ponds. On the eastern borders of the Big Marsh and ponds B and C, there is a steep slope of approximately 1-2 meters down to the water surface.

The increased gradient of the water table near the ponds, along with the high volume of water entering the ponds, creates interesting features in the area, most notably springs and vertical hydraulic gradients.

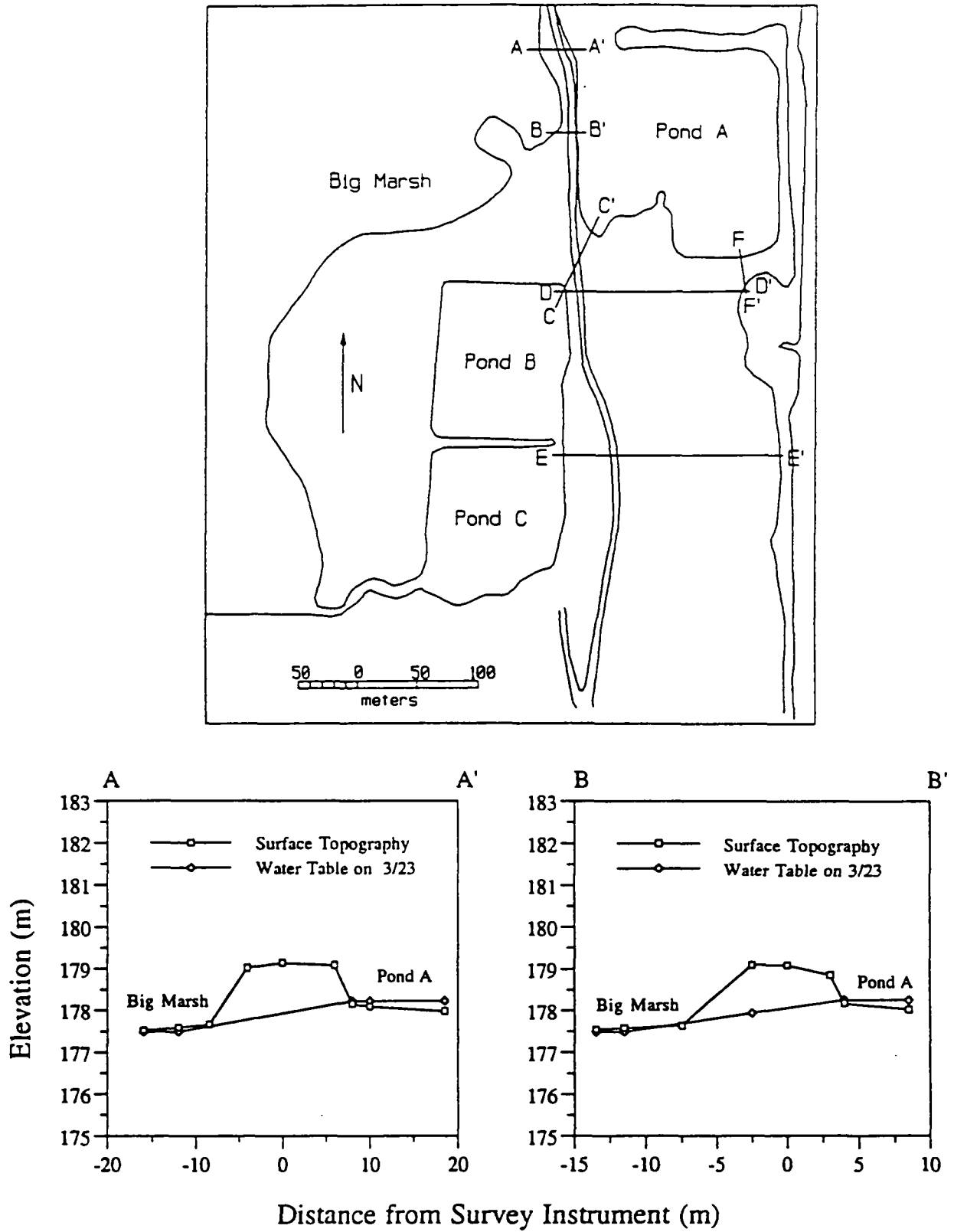


Figure 8. Cross-sections of the water table.

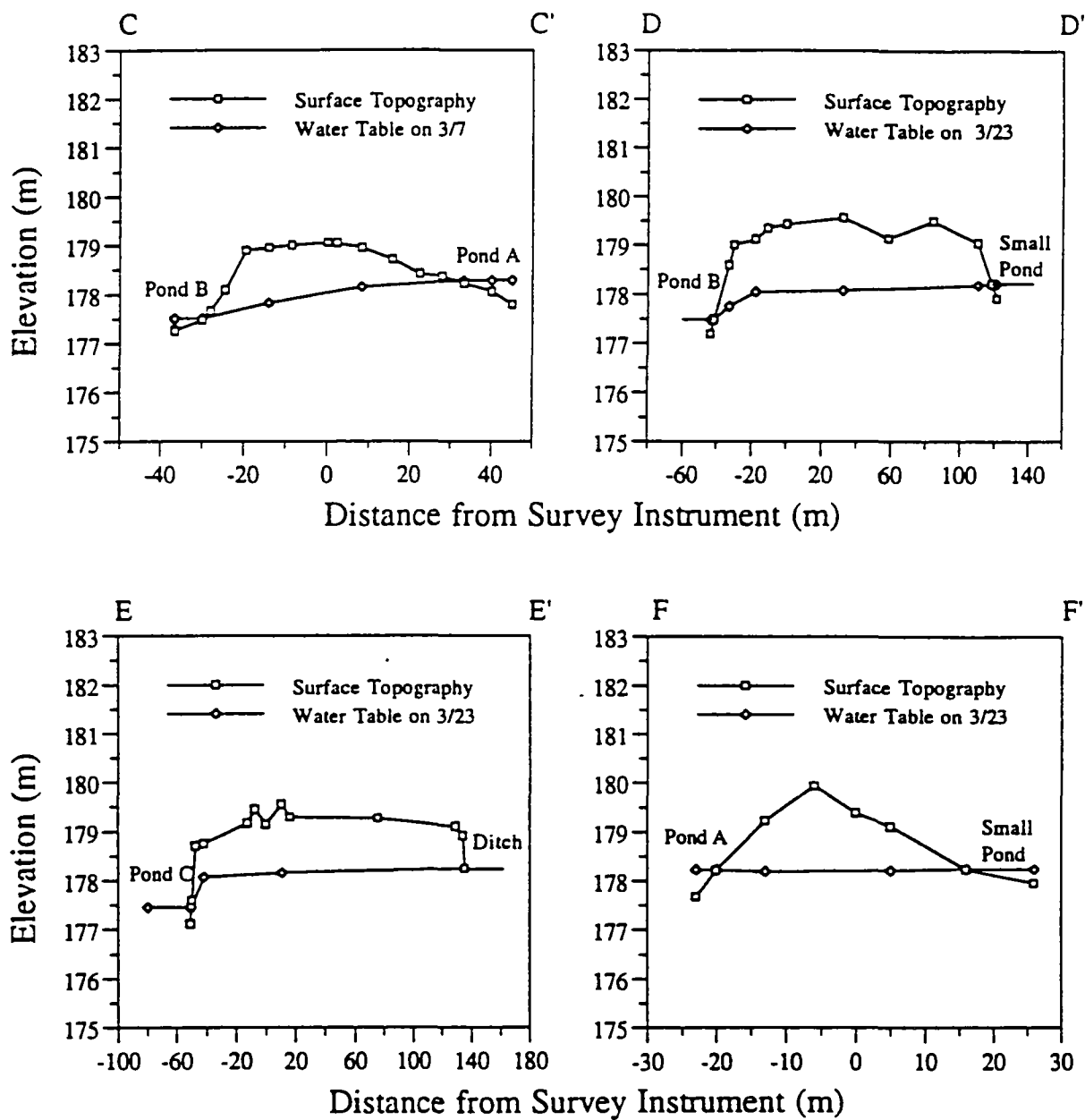


Figure 8. continued.

2. Existence of Macropores and Springs

The velocity of ground water flow usually is very slow, on the order of less than a meter per day. However, irregularities (preferential flow paths) in the aquifer matrix can greatly increase the flow velocity. These preferential flow paths are generally termed macropores. Most commonly macropores are in the form of fractures in the saturated zone, and animal or plant burrows in the unsaturated zone. Macropores give an aquifer a secondary hydraulic conductivity which may be orders of magnitude higher than the primary (intrinsic) hydraulic conductivity (Beven and Germann, 1982). Therefore, a very large percentage of the overall flow through an aquifer may flow through the macropores. If the macropore structure and density are known, the secondary hydraulic conductivity of the aquifer can be calculated.

Before the late 1800's, the field site consisted of all wetlands. The area has since been filled in with different materials. When material is used as fill, it is generally dumped off of a truck and may or may not be spread out and compacted. There are many hills on the field site made of fill in which the material was left just the way it was dumped from a truck. Therefore, the material is very poorly sorted, containing many rocks and larger pieces of slag and concrete. The likelihood of macropores existing in the near-surface fill material is therefore very great. The existence of macropore structures is confirmed by the presence of numerous ground water springs along the discharge boundaries of ponds B and C (Figure 9). The dissolution of minerals from the fill material as the ground water flows through may contribute to the existence and enhance the size of the macropores.

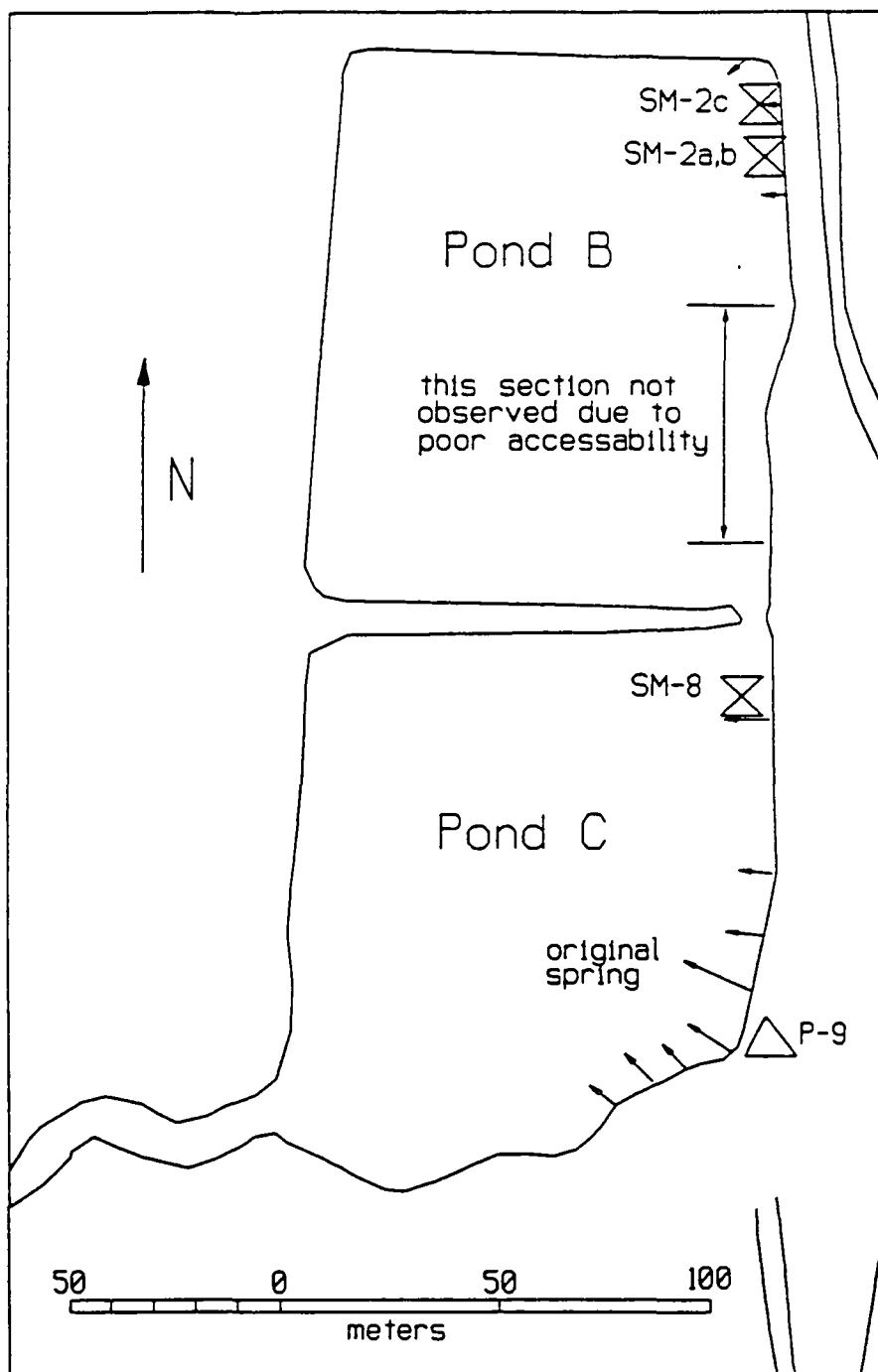


Figure 9. Active springs during January and February, 1994.

The eastern boundary of the Big Marsh and ponds B and C is a ground water discharge boundary. Based on Figures 4 and 8 (the water table map and the water table cross-section maps), the hydraulic gradient along this boundary is very large, up to 60 cm/m. This implies that a large volume of water is discharging into the ponds along the eastern boundary (or that the hydraulic conductivity of the material is low). If the material which the ground water is flowing through is homogeneous and isotropic, one would theoretically expect an equal discharge flux along the entire boundary. However, in the field area, the upper 2-3 meters of material consists of fill. Also, the average water table on the site occurs approximately at the interface between the fill and the naturally occurring silty clay. Therefore, water discharging along the eastern boundary of ponds B and C flows through the fill, and thus through any macropore systems that are present in the fill.

During regular measurements of the water levels, a spring was noticed along the shore of pond C near piezometer nest P-9. Water was seeping out of the fill material just above the water level in the pond. An examination of the spring showed that the water seeping out was warmer than the water in the pond. In addition, as the spring was blocked with soil, the water would begin to seep from adjacent areas. This indicated that the fill material contained extensive macropore systems and thus additional springs should be present along the shore.

Before the winter freezing of the ponds, a second spring was noticed along the bank in pond B near the in-water piezometer nest P-2W. A seepage meter was then installed over the spring to monitor the seepage rate over time.

Due to the difference in the temperature of the water seeping from the springs compared to that of the water present in the ponds, the wintertime was a good time to map the locations of the springs. During several warm periods in January and February 1994, the locations of the springs were easily identified due to the fact that ponds B and C were essentially frozen except for several lines of thawed

water extending perpendicular from the eastern banks. The relative seepage rate of the springs was apparent by the size of the thawed area around each one. Eleven springs were noticed along the eastern bank (Figure 9), with the original spring near piezometer nest P-9 being the largest. The seepage rate of this spring was measured at 7 liters per minute. The section of pond B from in-water piezometers P-2W to P-8W was not be observed due to problems with accessibility. Therefore, the existence of springs along this stretch could not be determined, but the likelihood is great due to channels in the bottom sediment observed before the pond froze. These channels were carved by the water flowing out of the springs.

Two things are apparent from Figure 9. First, the spacing of the springs is very regular, approximately 12-20 meters apart. Second, the springs are concentrated near the corners of the ponds, with more located in the southeast corner of pond C. In this area, additional water may be added due to the convergence of flow near the corner, leading to more springs. This suggests that the springs may have actually developed in response to the ground water flow field. In the northeast corner of pond B, the additional flow from pond A would concentrate more water near the corner of the pond.

3. Vertical Hydraulic Gradients

Nested piezometers are useful in determining if there are vertical hydraulic gradients in a flow system. Since ground water flows in response to hydraulic gradients, vertical gradients imply that the flow direction has a vertical component. Areas where vertical gradients commonly occur include ground water recharge areas (and ground water mounding) (downward gradients) and discharge areas (upward gradients).

Of the ten sets of nested piezometers on land, vertical gradients have been observed in only four of them (P-3, P-4, P-8, P-9)(Figure 10), indicating that flow in the area is predominantly horizontal. Piezometer nests P-4, P-8, and P-9 are located along the eastern borders of the Big Marsh and ponds B and C; nest P-3 is located between ponds A and B. The vertical gradients are all in the downward direction, since the water elevation in the shallowest piezometer (C) is higher than the level in the other piezometers.

Two mechanisms seem to be responsible for the presence and the relative magnitude of the vertical gradients: 1) steep topographic dropoffs along the eastern edge of ponds B and C, and 2) the occurrence of ground water mounding due to the filling-in of areas between ponds. The magnitude of the gradients depends on the contribution of each of the mechanisms. Recharge from precipitation also affects the magnitude of the gradients. This dependence on recharge from precipitation makes the observed gradients ephemeral features.

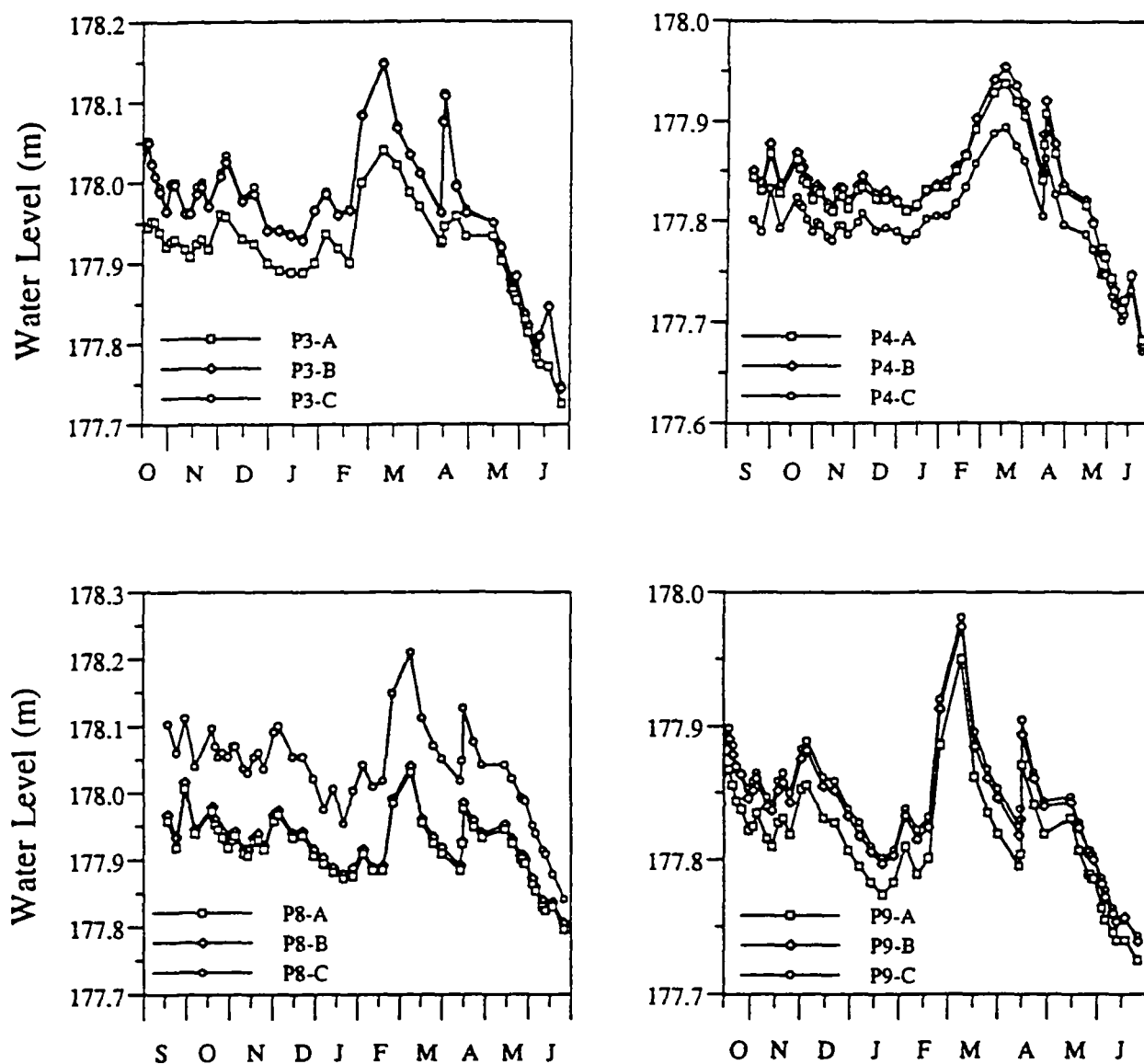


Figure 10. Vertical hydraulic gradients measured in piezometer nests P-3, P-4, P-8, and P-9.

The vertical gradients observed in nests P-4 and P-9 are associated with the steep dropoff down to the water table on the eastern borders of the Big Marsh and pond C. Ground water flow is governed by the LaPlace equation, in which the solution is dependent on the boundary conditions. Therefore, the water in the upper part of the flow regime needs to drop in elevation very quickly in order to discharge into the ponds (or else overland flow would occur, which has not been observed). Therefore, a vertical component of the flow is needed in the upper section.

The vertical gradient observed in nest P-3 is due to the steep hydraulic gradient between ponds A and B (Figure 8 section C-C'), and the magnitude of the vertical gradient is dependent on the magnitude of the hydraulic gradient between the ponds, which is a function of precipitation.

The vertical gradient observed in nest P-8 is associated with both the steep topographic dropoff along the eastern boundary of pond C and the slight ground water mounding which occurs between ponds B and C. Because of these two factors, the magnitude of the vertical gradient is the greatest of the four.

A steep dropoff also occurs down to pond B in the area near piezometer nest P-2. Therefore, a downward vertical hydraulic gradient should exist between the water levels in the piezometers. However, the levels do not indicate a significant vertical gradient (Figure 11a). The lack of the existence of the gradient is due to the bottoms of all three piezometers being well below the water level in pond B (Figure 11b). The vertical gradient does not extend to a great depth below the water table. This is evidence of the presence of a shallow ground water flow system.

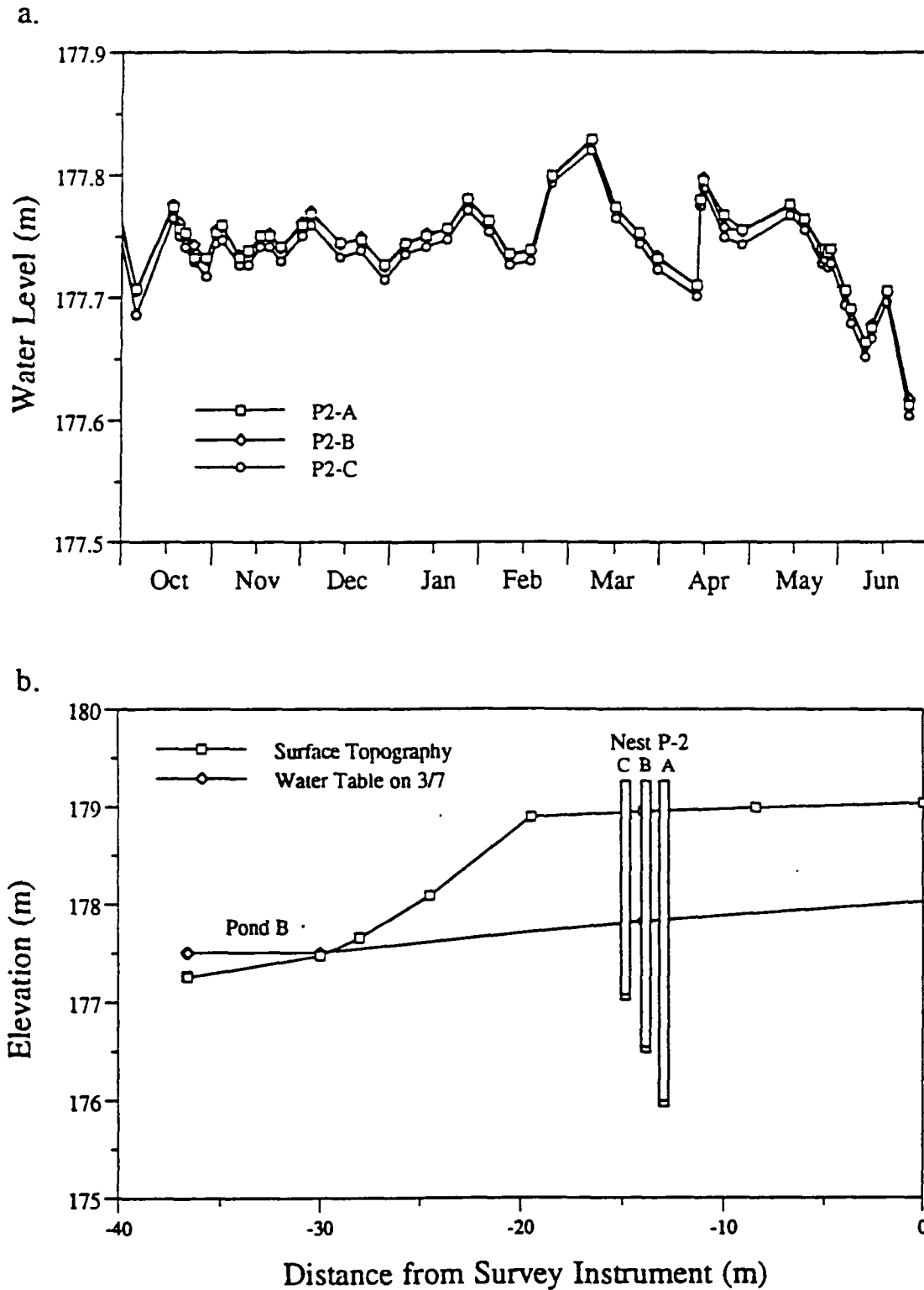


Figure 11. a. Water levels measured in piezometer nest P-2.
b. Water table cross-section near piezometer nest P-2 on March 7, 1994.

The existence of the macropores and springs along the eastern borders of ponds B and C may also contribute to the difference in the magnitude of the vertical gradients observed in nests P-8 and P-9 (probably for nest P-4 also, but data on the existence of springs near this nest is lacking due to limited accessibility caused by vegetation). The magnitude of the vertical gradient is a function of the difference between the height of the water table near the piezometer nest and the height of the pond (i.e. the hydraulic gradient). In addition, at steady state, the hydraulic gradient is related to the permeability of the matrix which the water is flowing through. Since the permeability of the macropores and the springs is much higher than that of the surrounding matrix, a smaller hydraulic gradient is needed to discharge water in areas where macropores are more common. Most of the springs are located in the corners of ponds B and C (i.e. the areas near nests P-2 and P-9) (Figure 9). Therefore, the hydraulic gradient and the magnitude of vertical gradients in these areas would be less than in the area near nest P-8, where less springs are located. The decrease in the number of springs near nest P-8 may also contribute to (or may be the sole cause of) the slight ground water mounding located there.

An analogous situation occurs in pipe flow theory. As the cross-sectional area of a pipe decreases (deposits in the pipe, for example), a larger pressure (hydraulic gradient) is needed to keep the discharge constant.

The ephemeral nature of the vertical hydraulic gradients is evident from Figure 10. From mid-April to early June, the Chicago area experienced drought conditions. The level of the water table dropped drastically and the vertical gradients measured in the piezometers practically disappeared.

4. Hydraulic Conductivity of the Aquifer

One of the most important aquifer properties which must be known in any ground water flow analysis is the hydraulic conductivity of the aquifer (K). This parameter appears in the calculation of the discharge per unit width in an unconfined aquifer, namely the Dupuit-Forcheimer equation,

$$q' = K(H_2^2 - H_1^2) / 2L$$

where q' is the discharge per unit width, H is the hydraulic head at a measurement point, and L is the distance between the measuring points. Two assumptions were made in deriving this equation from the more general equations for ground water flow: 1) flowlines are assumed to be horizontal and equipotential lines vertical (horizontal flow), and 2) the hydraulic gradient is assumed to be equal to the slope of the free surface and to be invariant with depth.

Several methods have been devised to measure K in the field. One of these is a "slug test". In this test, a known volume of water (a slug) is either bailed out of (or added to) a well in order to produce a drawdown (or rising) of the water table. The height of the water table is then monitored as the level returns to the initial level. One of the most common methods used to analyze the drawdown data obtained from a slug test is the Hvorslev (1951) method.

On the site, monitoring well MW-2 had a water level recording device connected to it. This well was chosen to receive the device because of its close proximity to the other piezometers. Hence, a slug test was performed on this well on October 25, 1993. A volume of water equivalent to a 0.61 meter rise in the water table was added to the well. During the test, the recording device was set to record the level of the water table every second. Two separate tests were performed in a 30 minute period.

The slug test data was analyzed using the Hvorslev (1951) method. Using this method, $K = 0.00058$ cm/s for test #1 and 0.00059 cm/s for test #2. From standard

reference tables, $K = .001$ cm/s is in the range of clean to dirty sand, which in general is the type of material which MW-2 is seated in (sandy, silty, clayey deposits).

Recent studies of the Lake Calumet region have reported values for the hydraulic conductivity of the unconsolidated sand and gravel aquifer which are in the same range as those of the slug test. Cravens and Zahn (1990) report conductivity values from the literature in the ranges from 10^{-5} to 10^{-3} cm/s for a landfill south of Lake Calumet and 0.00882 cm/s to 0.0353 cm/s for the Calumet aquifer of northeastern Indiana.

The calculated hydraulic conductivity was used in the Dupuit-Forcheimer equation to calculate the net ground water input into pond B as part of a water budget analysis of the pond (Water Budget Analysis section). From the analysis, it was found that the hydraulic conductivity of the fill material which the water flows through may be two orders of magnitude higher than that calculated from the slug tests, due apparently to the presence of preferential flow paths in the fill material.

5. Seepage Rates

Seepage meters were installed in the ponds to directly measure the volume of water moving into and out of the ponds. The design of the meters is similar to that described by Lee (1977) and Lee and Cherry (1978). The meters were made by the Illinois State Water Survey by cutting a 55-gallon steel drum in half and drilling two holes, one on top and one on the side. After installing the meters approximately 2/3 into the sediment and achieving a good seal, air was forced out and the top hole was sealed. Measurements were taken by connecting a plastic bag with a known volume of water to the side hole. After an amount of time, the volume in the bag was measured. If the volume increased, the seepage rate was positive; if the volume decreased, the rate was negative. Seven meters were used (three in pond A, three in pond B, one in pond C; Figure 3) to study the spatial and temporal variability in the rates.

A high degree of spatial and temporal variability in the seepage rates occurs within and between the ponds (Figure 12). This has also been the case in other studies which have used seepage meters. The values range over three orders of magnitude. Also, the seepage direction is directly related to the ground water flow direction.

The variability in the seepage rates for the meters installed in pond A (SM-1, SM-5, and SM-6) is attributed to their location relative to the mean ground water flow direction. Seepage meter SM-6 is located along a shoreline which is parallel to the mean ground water flow direction. Therefore, not much water would be expected to be transferred between the pond and the ground water, thus contributing to essentially a zero seepage rate (Figure 12a). On the other hand, meters SM-5 and SM-1 are located along a shoreline which is perpendicular to the mean ground water flow direction, leading to more water being transferred between the ground water and the pond, and thus to a higher seepage rate.

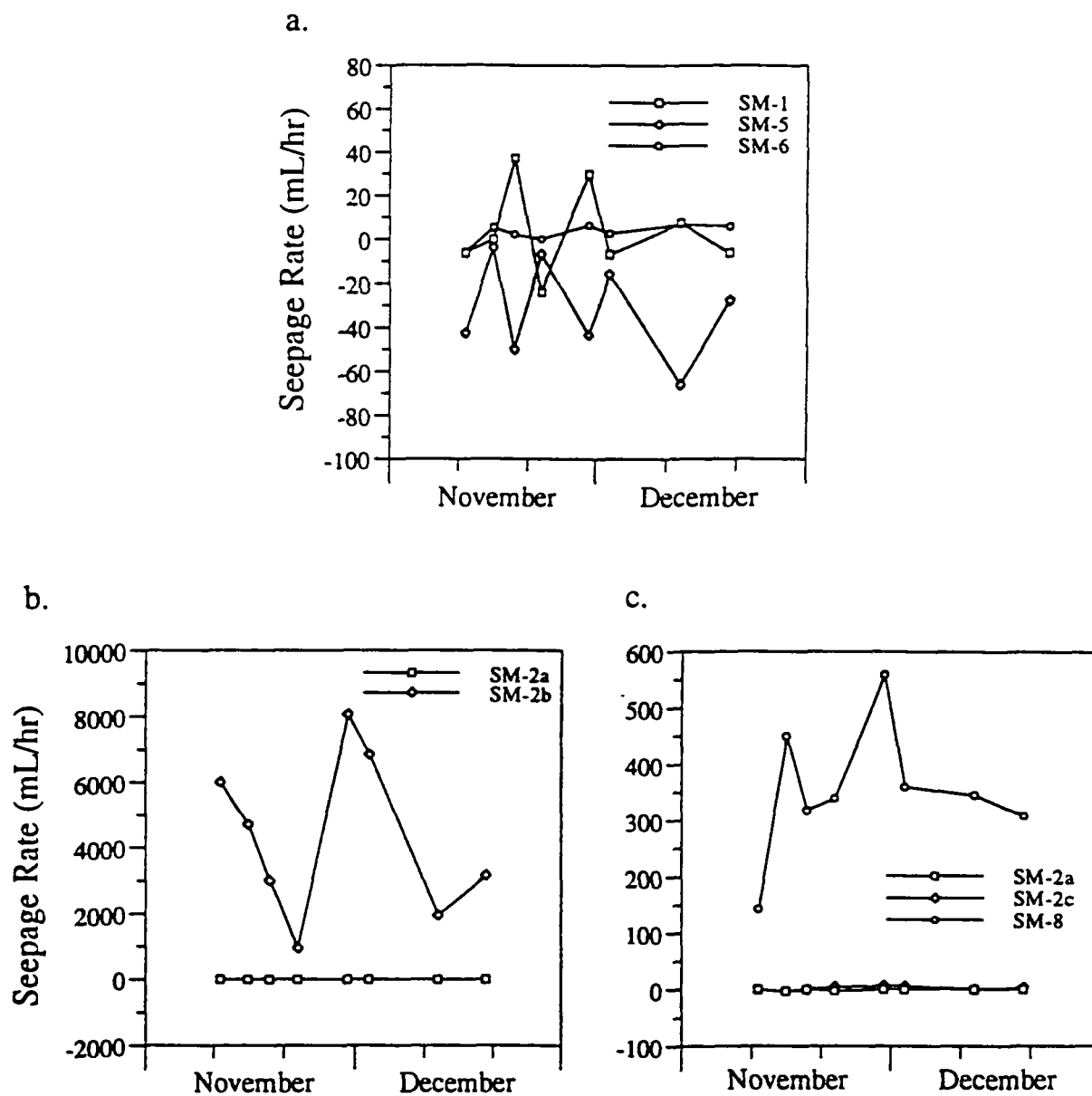


Figure 12. Seepage rates measured for the meters located in:

a. Pond A b. Pond B c. Ponds B and C.

The magnitude of the seepage rate and also the seepage direction measured in SM-1 varies over time (Figure 12a). Between precipitation events, the water table is lower and water flows out of the pond near SM-1, leading to a negative seepage rate. However, after an event, the water table is higher and a small flow reversal occurs and water flows into the pond near SM-1, leading to a positive seepage rate.

Cherkauer and Zager (1989) observed a flow reversal caused by the fluctuating height of a ground water mound. Their study indicated that a divide existed which separated ground water flowing in the direction of the local regional gradient from that flowing in the opposite direction due to the gradient induced by the ground water mound, and that the location of the divide moved toward or away from the shoreline depending on the height (strength) of the mound.

Figure 13 indicates that the level of pond A is always higher than the height of the water table. This suggests that a ground water mound is not present in the area. However, this cross-section is not parallel to the mean ground water flow direction and an existing mound may not have been observed by the piezometer network. Alternatively, the water that flows into the pond after a precipitation event may be due to an area of high hydraulic conductivity near SM-1 which could cause a small, short-lived reverse flow cell.

The movement of water into pond A near SM-1 during periods when the water table is higher has a direct affect on the magnitude of the seepage rate measured in SM-5. Water flowing into the pond near SM-1 causes the water in the pond to flow toward SM-5 (Figure 14a), producing a higher flow rate out of the pond near SM-5 (higher negative seepage rate). When the water table lowers and the flow reversal ceases, water again flows out of the pond near SM-1, and the water in the pond is not forced toward SM-5 (Figure 14b), leading to a reduced flow rate out of the pond near SM-5 (reduced negative seepage rate). Thus, the seepage rates for SM-1 and SM-5 display an opposite nature (Figure 12a).

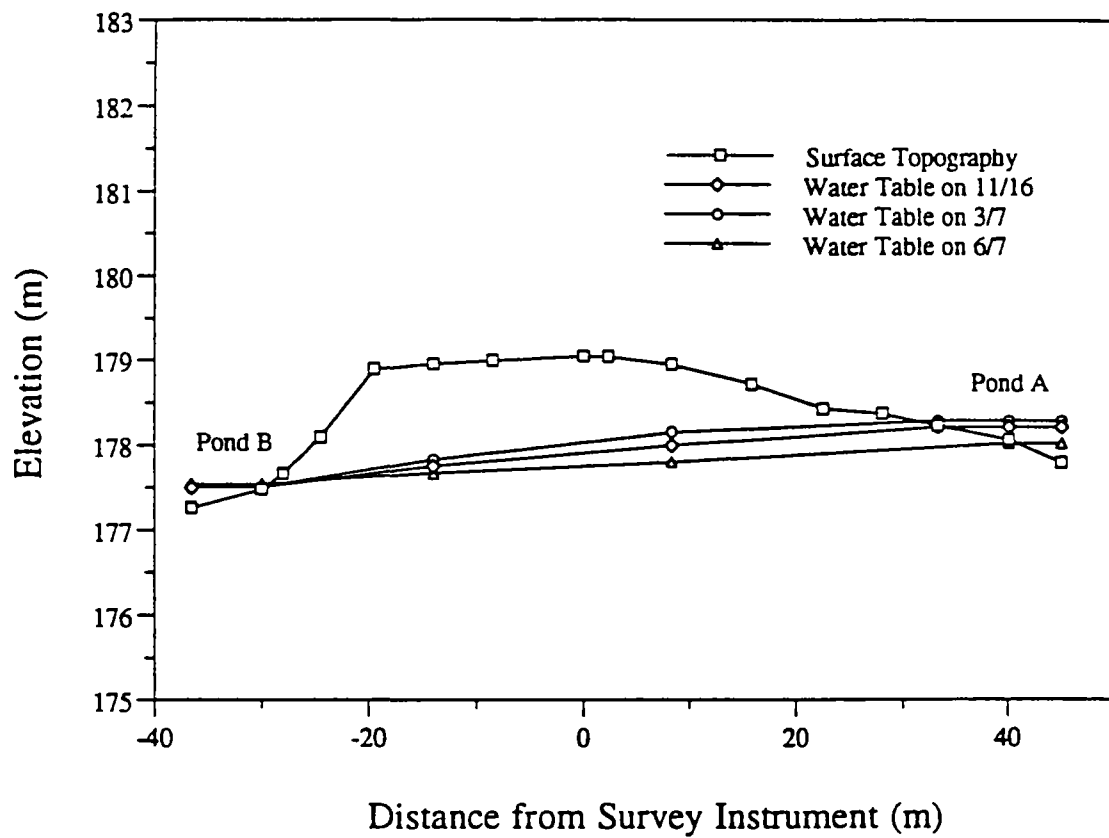
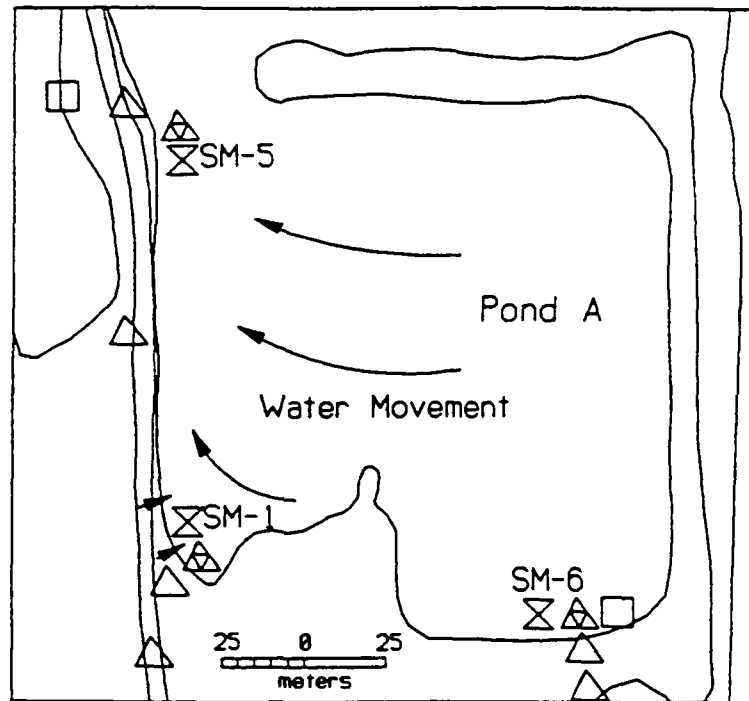


Figure 13. Water table cross-section between ponds A and B on 11/16/93, 3/7/94, and 6/7/94.

a.



b.

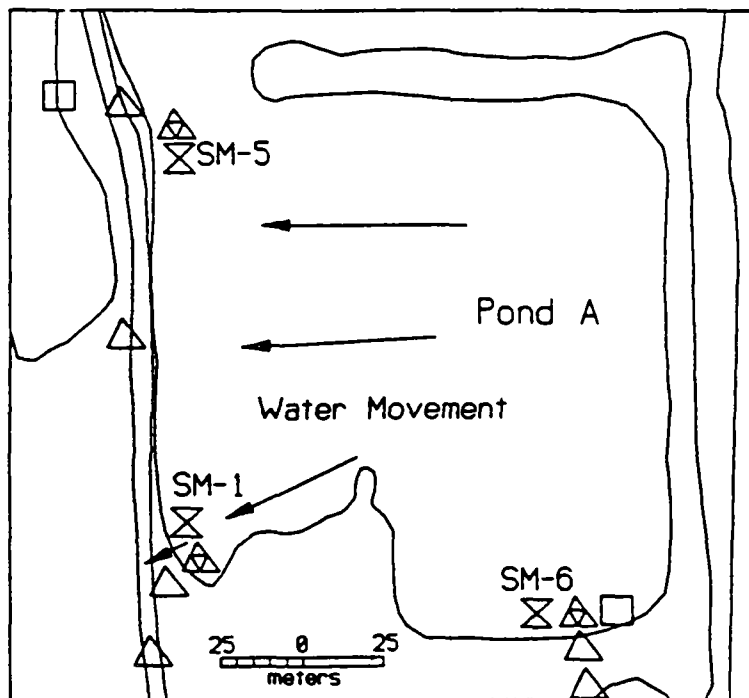


Figure 14. Water movement in pond A at times of:

a. Higher water table b. Lower water table.

The spatial variability in the measured seepage rates from the meters installed in ponds B and C (SM-2a,b,c and SM-8) is associated with the location of the individual meters with respect to the locations of the macropore systems and springs. A large volume of water flows into the ponds along their eastern borders. This water flows through the macropore systems in the fill material, leading to the eleven springs identified along the banks (Figure 9). Meter SM-8 is located near one of the springs, and consequently shows a high seepage rate (Figure 12c). Meter SM-2b was installed over a spring to directly measure the flow rate of the spring (Figure 9). Meters SM-2a and SM-2c are located between two springs and show essentially a zero seepage rate (Figures 12b&c). (Meter SM-2c was installed near SM-2a in order to corroborate the zero seepage rate.) This drastic change in the seepage rate over a distance of a few meters is evidence that a large percentage of water influx into ponds B and C flows through the macropore systems and springs.

The temporal variability in the measured seepage rates for SM-2c and SM-8 is a function of the difference between the height of the water table near the meters and the water levels in the ponds (the hydraulic gradient). When the difference between the levels is high (after a precipitation event), the seepage rates into the ponds are higher, and when the difference is lower, the rates into the ponds decrease (Figures 12b&c).

B. Water Table Response to Precipitation Events

Measurements of the water level in the piezometers were taken approximately once to twice weekly for the 9-month period from September 1993-June 1994. Measurements of daily and weekly precipitation amounts were also taken for the same period using both a manual and a recording rain gauge. During the winter months, the precipitation amounts were obtained from an Illinois State Water Survey recording station located at Wolf Lake, approximately 5 kilometers southeast of the site. During the winter months, all the ponds froze over, causing the water level measurements to rise drastically and have an erratic nature.

In addition, two water level recording systems were installed to constantly monitor water levels: one was installed on one of the monitoring wells (MW-2); the other recorded the level of pond A.

1. Characteristics of Water Table Fluctuations

Plotting the measured water levels versus time for several of the piezometers reveals information on the response of the shallow water table.

1) The magnitude of water table fluctuations is greater than that of fluctuations of the surface water bodies (Figure 15a). This is due to the fact that the storage capacity of a surface water body causes low magnitude rises which occur slowly, whereas the porosity of the matrix will influence the magnitude of ground water fluctuations. This effect can lead to ground water flow reversals, especially near surface water bodies (Cherkauer and Zager, 1989).

2) The magnitude of water level fluctuation is a function of the distance from the piezometer to the surface water bodies (Figure 15b). The water level in the piezometer closer to the ponds (P-5C) has lower magnitude fluctuations than the piezometer further from the ponds (MW-3). The piezometers closer to the ponds are more affected by the ponds, which act to keep the water levels constant. The low magnitude rises of the water table near the ponds is evidence that considerable discharge to the ponds occurs during precipitation events.

3) Water level fluctuations of the ponds depend on whether an individual pond is primarily a recharge or discharge pond (Figure 15c). Pond A recharges the ground water along its western border, whereas pond B discharges ground water along its eastern border. On April 11, there was a major precipitation event. After this event, not much rain fell until mid-June. Consequently, the water level of pond A rose quickly on April 11, then fell steadily due to the drought conditions. However, the water level of pond B continued to rise for approximately one month. The extended rising of pond B is due to the discharge of water into the pond long after the precipitation event ended.

4) Water level fluctuations of the individual discharge ponds depends on the size of the pond (Figure 15d). Before the winter freezing, the level of the Big Marsh

was slightly lower than that of pond B. However, after the spring thaw, the level of the Big Marsh was now slightly higher than that of pond B, and continued to be higher into June. The reversal in the levels is due to the Big Marsh being larger and thus having a larger drainage basin area. Therefore, more water discharged into the Big Marsh, causing the level to be higher. The prolonged discharge from the rain event of April 11 also helped to keep the level of the Big Marsh higher than that of pond B.

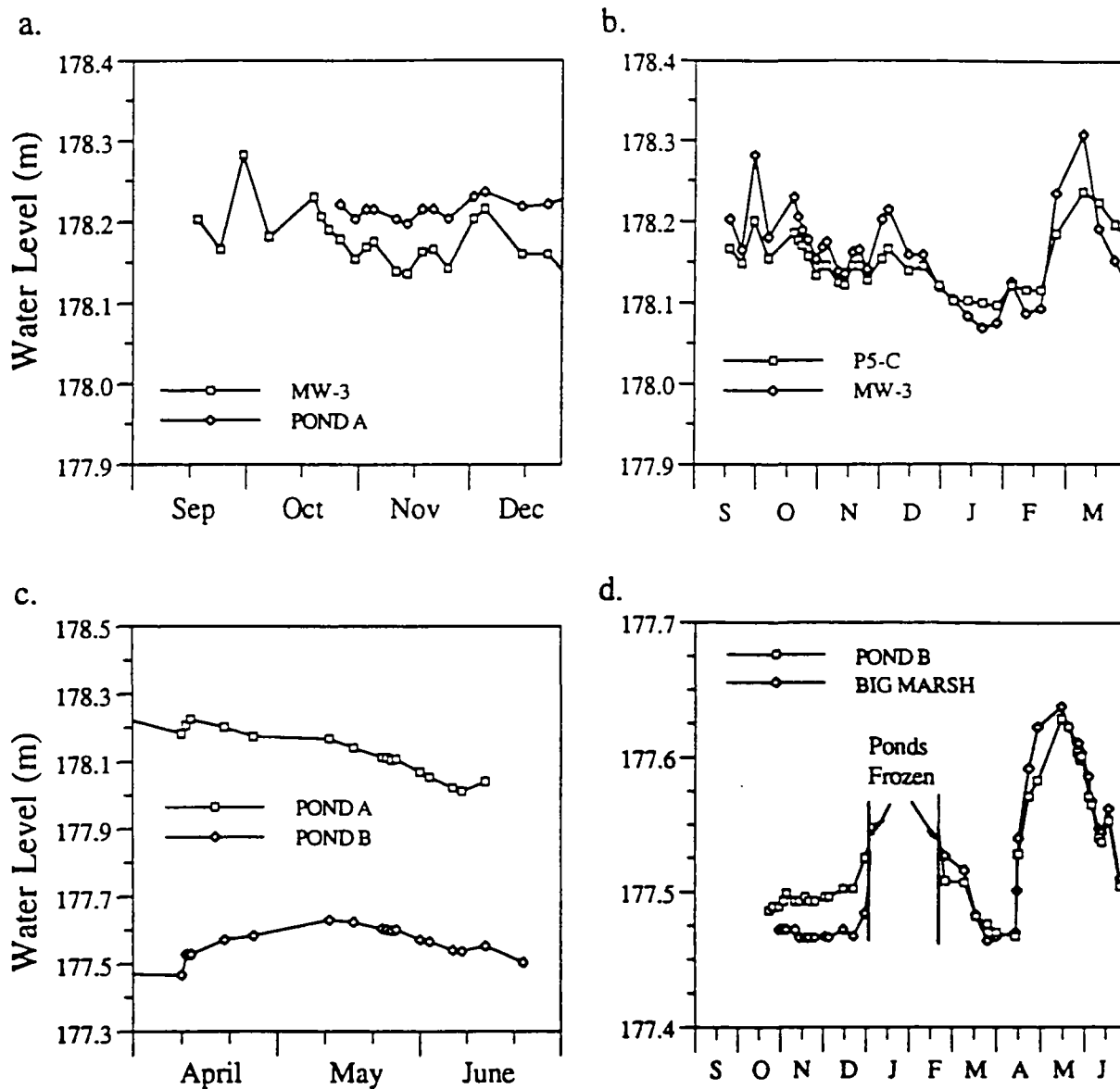


Figure 15. Differences in water table fluctuations between: a. Ground water and surface water, b. Points closer and further away from the ponds, c. Discharge and recharge ponds, d. Larger and smaller discharge ponds.

2. Water Level Recorder Data

The data from the water level recorders was plotted along with the precipitation data (Figure 16). The figure confirms the expected result that water table fluctuations are related to precipitation. The figure also shows that there is a lag time between the beginning of precipitation and the rising of the water table. This lag time is expected and is attributable to the time it takes for water to infiltrate through the unsaturated zone down to the saturated zone. To investigate the lag time of the ponds and the shallow water table in more detail, three individual precipitation events were monitored (Event Recording section). However, the recording device on pond A malfunctioned during the first event. Therefore, only the lag time of the water table near MW-2 was studied.

During the months of January and February 1994, the ponds and the ground were frozen, inhibiting the infiltration of water. Therefore, water level fluctuations do not correlate with precipitation during these months. However, several warm weather intervals occurred in which the ponds and ground frost partially thawed, causing the water levels to rise after a lag time probably associated with the slower thawing of the soil below the surface. Therefore, water level fluctuations during January and February correlate better with temperature than with precipitation (Figure 17).

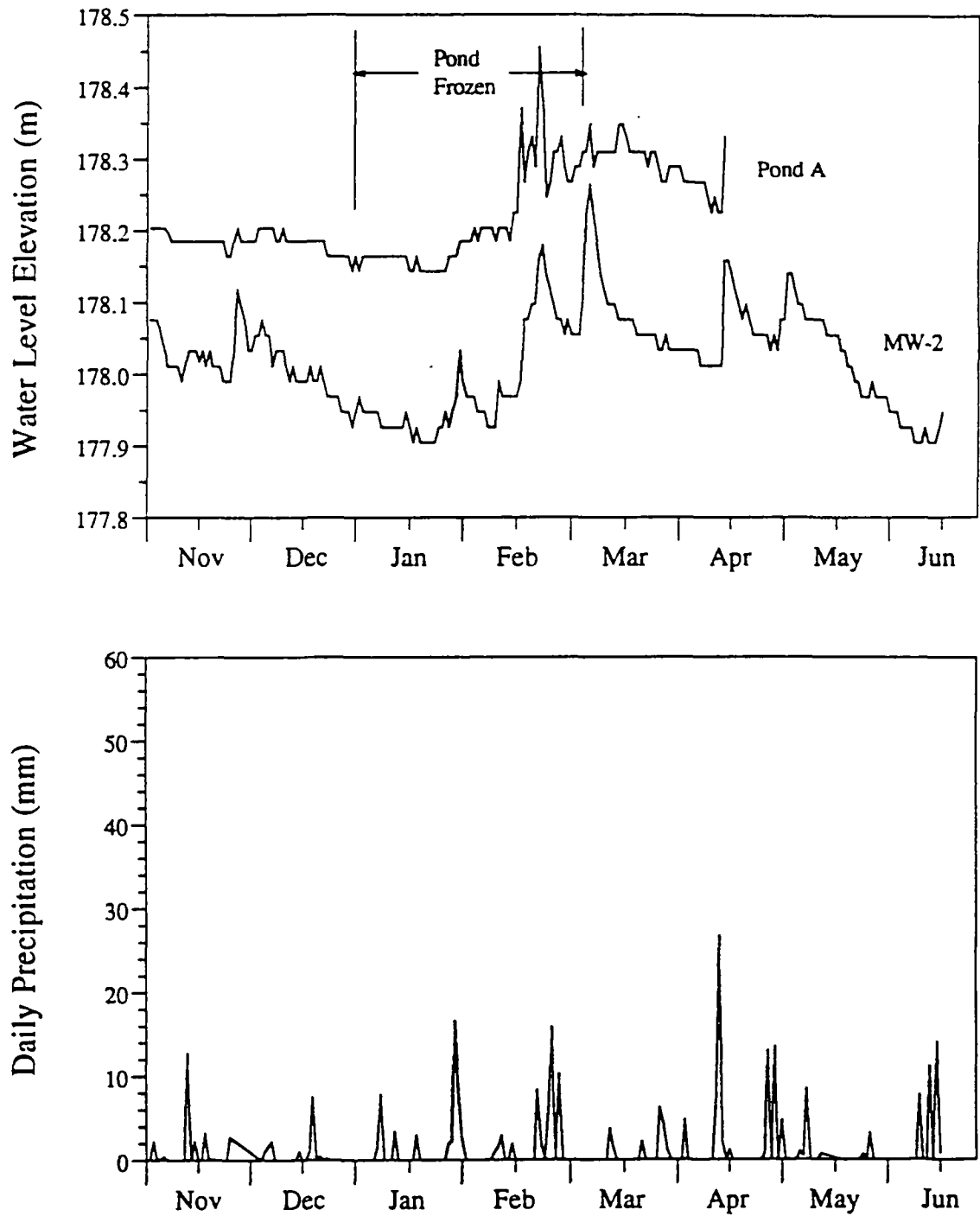


Figure 16. Water levels and precipitation measured by the recording devices.

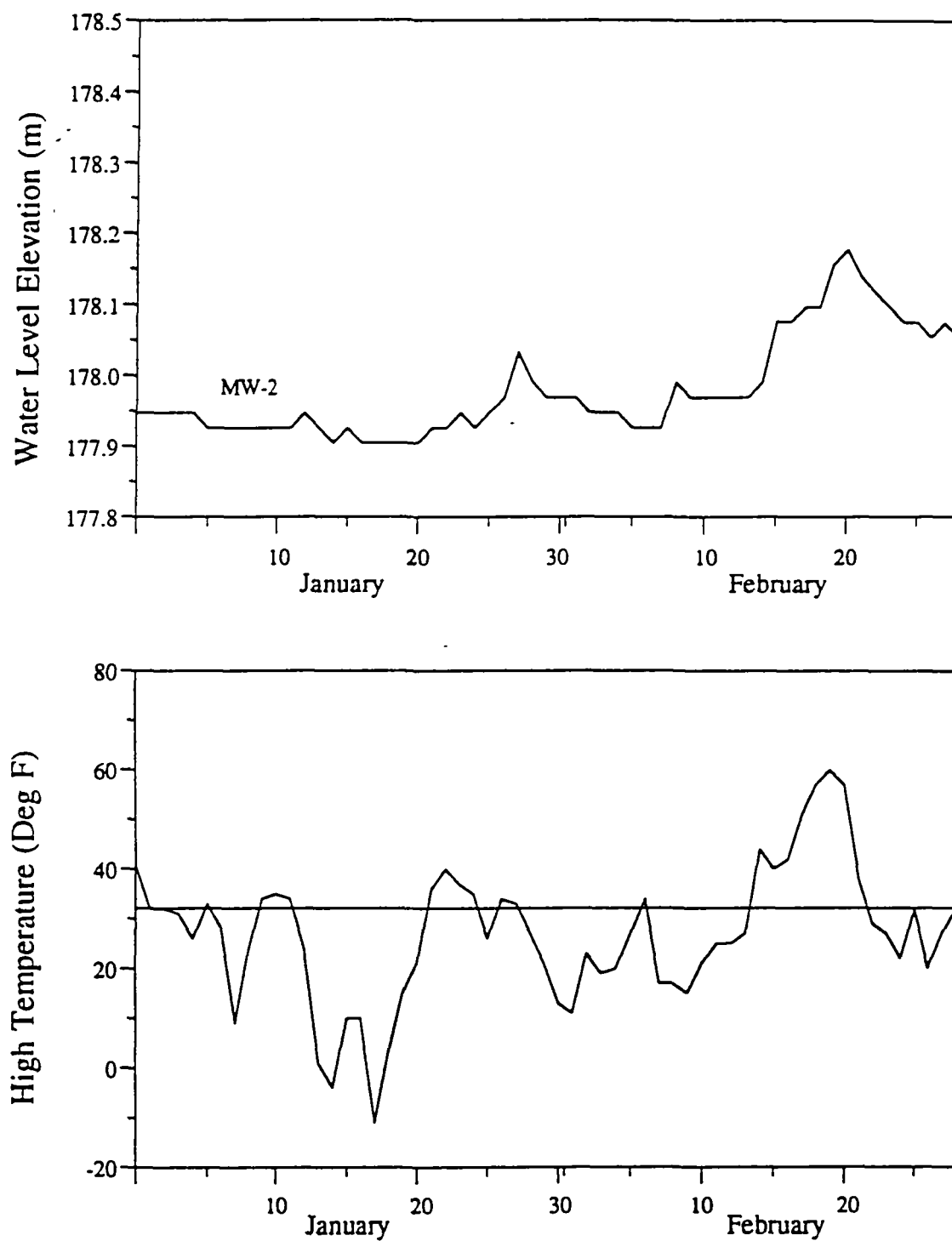


Figure 17. Measured water levels in MW-2 and high temperature for January and February, 1994.

3. Water Levels Measured at Different Time Intervals

A drawback to graphs such as those of Figure 15 is that they only show the water levels at the times when measurements were taken. Therefore, they may underpredict the maximum and minimum levels and when these occur. In other words, they give snapshots of the water levels, but relate no information about what happened to the levels between the measuring periods. For example, during a measuring interval, the water level may have risen (or fallen) a substantial amount, but then recovered to end up at the same level. Therefore, it appears that the level did not change. This effect could introduce large errors if this type of data set was used in a contaminant flux model.

To investigate this problem, the data from the water level recorders was used to produce 1-day, 5-day, 2-week, and 1-month graphs of the water levels (Figure 18a). These graphs are meant to approximate the graphs which would result if "snapshot" measurements of the levels were taken at these time periods. In general, all four graphs appear similar, having the same overall shape. However, as the measuring period increases, the peaks and valleys in the graphs become attenuated, decreasing the resolution of the graphs. Up to the 2-week graph, the main seasonal highs and lows in the levels are still apparent. However, increasing the time period up to 1-month reduces the resolution so much that the peak in the levels during March is not even evident. Therefore, based on the available data, a visual examination of the graphs concludes that the general nature of seasonal water table fluctuations for the site can be determined from a measuring program in which measurements are taken at least bi-monthly.

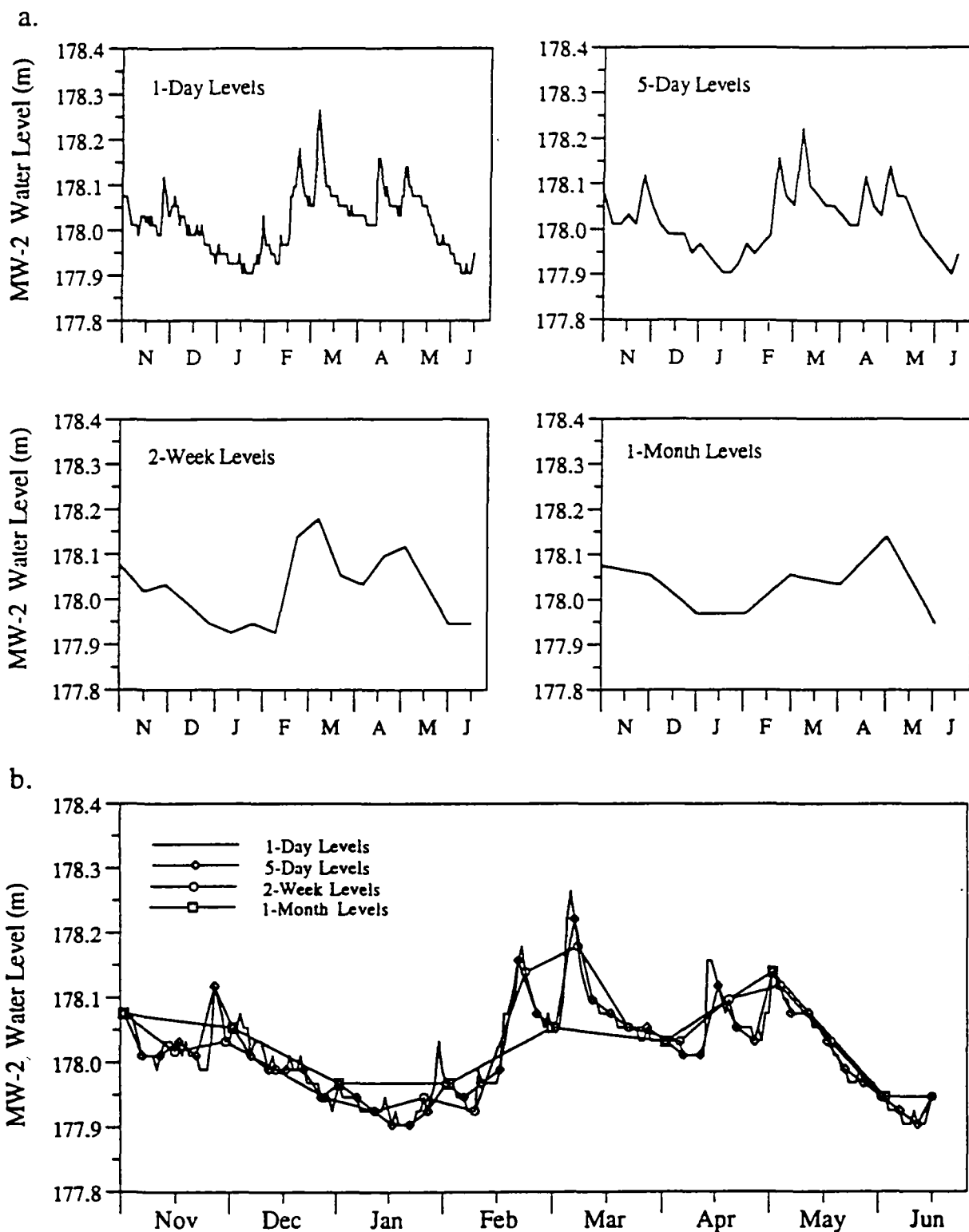


Figure 18. Recorded water levels at different time periods.

To statistically determine the extent of the similarities of the graphs, the area under each curve (above the arbitrarily selected level of 177.8 meters) was graphically estimated. The results are listed in Table 2:

TABLE II
AREA UNDER CURVES OF RECORDED WATER LEVELS
AT DIFFERENT TIME PERIODS

<u>Curve</u>	<u>Area under curve</u>	<u>% of 1-Day Curve</u>
1-Day	10,329 units	100%
5-Day	10,328 units	100%
2-Week	10,500 units	102%
1-Month	10,600 units	103%

The results indicate that the graphs are essentially equivalent to each other. As the measurement period increases up to 1-month, the overestimation of the overall water levels is only three percent. Therefore, in a modelling program using these graphs, the volumes predicted would be the same, but the timing of the volume peaks would be different. The approximate equivalency of the areas under the curves shows that the longer measurement period graphs essentially take the average of the peaks and valleys of the shorter period graphs. This can be seen by overlaying the four graphs on top of each other (Figure 18b). [The overestimation produced by the larger measurement intervals is an artifact of the timing of the

measurements. Depending on when the measurements are taken, an overestimation or an underestimation may occur for the longer intervals.]

The main conclusion to be drawn from the visual and statistical analysis of the graphs is that different measurement periods are needed depending on the data resolution required:

- 1) For long-term monitoring (over nine months), monthly measurements are sufficient.

- 2) For seasonal monitoring, monthly measurements may introduce errors since the correct timing of the seasonal highs and lows may not be shown. A measurement period of at least bi-monthly is needed.

- 3) For short-term monitoring (3 months and less), a measurement period of at least 5-days is needed. However, a shorter period is required if accurate data on the individual highs and lows in the water levels is needed.

4. Event Recording- Lag Time of Water Level Response

To assess the rate of water table fluctuation on a precipitation event basis, three individual events were monitored. A recording rain gauge with a 1-day period was set-up to measure precipitation at 9-minute intervals. The water level recorders were then set to record the levels at 10-minute intervals. The data from the events was used to determine the lag time from the beginning of the event to a change in the level of the water table. The lag time is associated with infiltration, as it affects the rate of recharge through the unsaturated zone. The infiltration rate is dependent on several factors, including the moisture content of the unsaturated zone prior to rainfall and the presence of preferential pathways in the unsaturated zone. In theory, a surface water body should have a lower lag time since precipitation falls directly on the surface, but the lag time will increase with the size of the water body due to the increasing volume needed to raise the level. Evaporation from the surface of the water body will also increase the lag time. Therefore, the lag time of a surface water body may be highly variable.

The data from the three events is summarized in Table 2. Figure 19a shows the cumulative precipitation curve and the fluctuation of the water level of MW-2 and of pond A to event #1 (April 11-12). For this event, precipitation fell in three waves. During the first wave, 5.5 mm of rain fell in 11 hours. In the second wave, 15 mm fell in 4 hours. In the last wave, 6 mm fell in 8 hours. During the entire storm, 26.5 mm of rain fell in 24 hours, with the maximum intensity of 3.75 mm/hr occurring approximately 13 hours after the start of the event. Pond A was first to respond to the precipitation. Approximately 10 hours after the start of the rain, the level of the pond rose 2 cm. The lag time associated with the water table near MW-2 was approximately 12 hours. The shorter lag time of Pond A is probably due to the direct precipitation and the relatively small area of the pond (leading to less storage). Shortly after the level of the pond changed, the water level recorder malfunctioned.

TABLE III
PRECIPITATION EVENT RECORDING DATA

	Event #1	Event #2	Event #3
Date	4/11/94	6/11/94	6/13/94
Time	11:00	17:00	3:00
Duration (hr)	24	3	1.25
Total Amount of Rain (mm)	26.5	11.5	9.25
Maximum Intensity (mm/hr)	3.75	7	7.5
Lag Time Of MW-2 (hr)	12	16	6.5
Time Since Last Major Rainfall Event (days)	7	>14	1.35
Total Water Table Rise (cm)	13	2.2	2.1

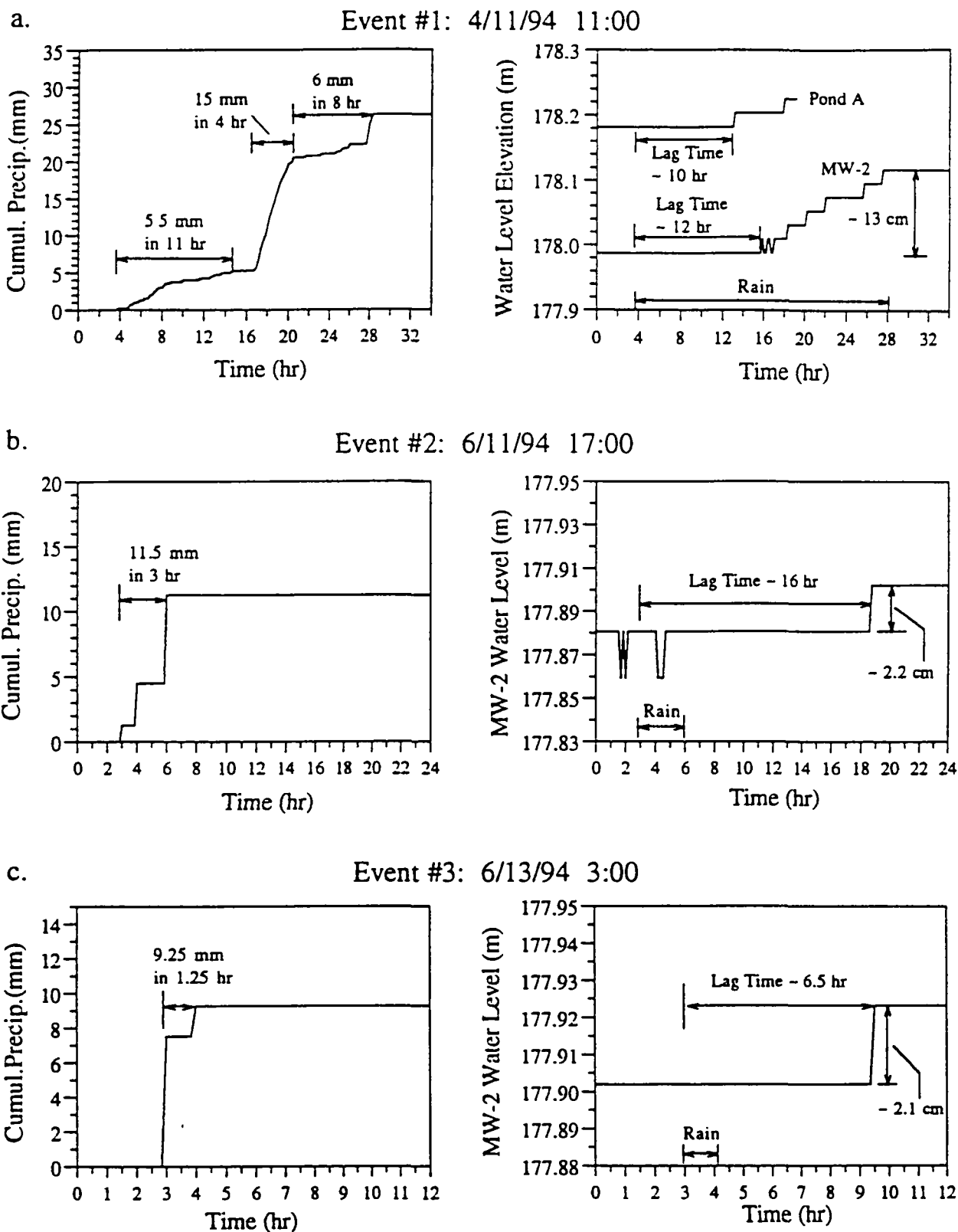


Figure 19. Cumulative precipitation and water levels measured for three precipitation events.

The water table near MW-2 rose steadily after the initial lag time. The total rise of 13 cm was reached approximately 12 hours after the initial rise, 10 hours after the maximum intensity of the storm, and 24 hours after the start of the event.

The precipitation of event #2 (June 11) also fell in 3 waves. The total duration of the storm was approximately 3 hours, with a total of 11.5 mm of rain falling (Figure 19b). The lag time associated with the event was approximately 16 hours. The water table rose very quickly with a total change of 2.2 cm.

Event #3 (June 13) was similar to event #2. The duration was approximately 1.25 hours, with a total of 9.25 mm of rain falling (Figure 19c). The water table also rose very quickly, with a total change of 2.1 cm. The lag time associated with the event was only 6.5 hours.

The difference in the lag time associated with each event is directly influenced by the incipient moisture content of the unsaturated zone prior to the events. When the moisture content is low, the infiltration rate is slow, leading to a higher lag time. When the moisture content is high, the infiltration rate increases and the lag time is lower. Prior to event #1, the moisture content was slightly low because there was no precipitation for the previous 7 days. This led to a higher lag time. However, prior to event #2 there was a period of over 14 days with no rain, then a small storm arrived 2 days before the event. Therefore, the moisture content was probably still very low, leading to an even higher lag time. Since event #3 occurred only 34 hours after event #2, the moisture content was high. This led to a higher infiltration rate, and consequently to a lower lag time.

5. Water Budget Analysis of Pond B

A useful way of describing the volume of water moving through a surface water body is to perform a water budget analysis. The analysis involves determining the different ways in which water may enter or leave the water body and calculating volumes for each component. The equation which the water budget must satisfy is:

$$\text{Inputs} = \text{Outputs} + / - \text{Changes in Storage}$$

A water budget analysis is most often done on a seasonal basis.

Using the data collected, a water budget analysis was performed on Pond B. This pond was selected because it is a small enclosed pond with no overland flow, no surface water sources, and only one surface water exit. The pond is rectangular with dimensions of approximately 125 m by 105 m.

Water fluxes per minute were calculated using data collected on June 9, 1994. Since there was no precipitation on June 9 and the level of the pond remained essentially constant, the general form of the water budget equation for the pond was:

$$\text{Net Ground Water Flux} = \text{Stream Flow} + \text{Evaporation}$$

Table 3 summarizes the data used in performing the analysis.

TABLE IV
WATER BUDGET ANALYSIS OF POND B
JUNE 9, 1994

Pond Dimensions	125 m by 105 m
Surface Area	13230 m ²
<u>Stream Flow</u>	
Cross-sectional Area	2.9 m ²
Average Surface Velocity (u _s)	0.03 m/s
Average velocity (u)	0.02 m/s
Discharge (Q)	0.06 m ³ /s, 3600 L/min

<u>Evaporation</u>	
Average Temperature	59 F
Average Dew Point	38 F
Average Wind Speed	193 mi/day
Percent of Cloud Cover	34%

Solar Insolation (From Graph)	395 Lang/day
Evaporation Rate (From Graph)	4 mm/day
Volume of Water Evaporated	53 m ³ /day, 37 L/min

Total Volume of Water Lost from The Pond= 3600 L/min+37 L/min= 3637 L/min

<u>Net Ground Water Flux</u>	Dupuit Forcheimer Eqn. (L/min/m)	Flux Rate (L/min)
North Border (105 m)	0.005	0.5
South Border (105 m)	-0.124	-13
East Border (125 m)	0.4	50
West Border (125 m)	0.004	0.5

Total Volume of Water Added to the Pond = (0.5-13+50+0.5) L/min= 38 L/min

a. Stream Flow

The only surface water exit in the pond is the connection between ponds B and C. On June 9, a survey level and rod was used to construct a cross-section of the connection. The calculated cross-sectional area of the water (A) was 2.9 m^2 . Four timings of the surface water velocity flowing between the ponds were also done. It has been shown that the average velocity of a stream is approximately 0.6-0.8 that of the average surface velocity. Only one of the timings was not affected by the wind. Therefore, that timing was used as the average surface velocity (u_s), which was 0.03 m/s . Multiplying by 0.6 gave an average streamflow (u) of 0.02 m/s . Therefore, the discharge (Q) through the connection ($Q=uA$) was approximately $0.06 \text{ m}^3/\text{s}$, or 3600 L/min .

b. Evaporation

The volume of water taken out of the pond through evaporation was determined using graphs from Hamon et al. (1954) and Roberts and Stall (1966). The data needed to use the graphs was the average temperature, the average dew point, the average wind speed, and the percent of cloud cover. This data was gathered through the Illinois State Water Survey for O'Hare International Airport in Chicago. For June 9, 1994 the average temperature was 59 degrees Fahrenheit, the average Dew point was 38 degrees Fahrenheit, the average wind speed was 193 miles/day, and the average cloud cover was 34 percent. Using the graphs, the daily evaporation was approximately 4 mm/day.

Data collected at the field site during November and December 1993 indicate that the evaporation rate may be ten times higher than that predicted by the graphs for these months. Data input into the graphs for an average day during mid-November and mid-December was taken from the National Oceanic and Atmospheric Administration (NOAA) Monthly Summary of Local Climatological Data for O'Hare International Airport in Chicago. The daily evaporation rate predicted from the graphs was 2 mm/day for November and 1.5 mm/day for December. However, data collected by the water level recorder on Pond A shows that during November the water level fell approximately 19 mm during the day and recovered at night; for December the decline was approximately 18 mm (Figure 20). The decline in the levels during the day are attributed primarily to evaporation from the pond surface (transpiration should be negligible during these months).

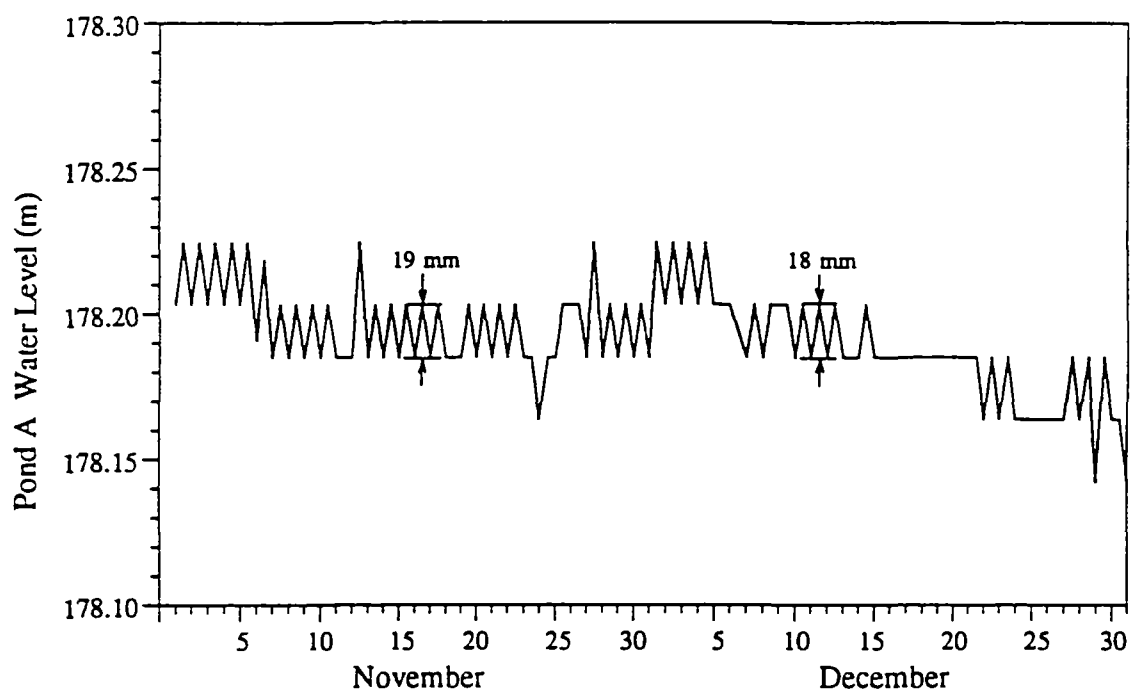


Figure 20. 12-hour water level recorded for pond A during November and December, 1993.

Multiplying the evaporation rate of 0.004 m/day by the surface area of the pond (13230 m^2) gives a volume of water evaporated per day of $53 \text{ m}^3/\text{day}$, or approximately 37 L/min. If the evaporation rate were ten times higher, the volume would be 370 L/min, which seems unrealistic. This indicates that something more than just evaporation contributes to the observed daily decline in the water level of pond A.

Combining the volume flowing between the ponds with the volume from evaporation gives a total volume of water taken out of the pond of 3637 L/min. Since the level of the pond remained constant, this must equal the net ground water flux into the pond.

c. Net Ground Water Flux

The Dupuit-Forcheimer equation was used to calculate the volume of water flowing into the pond along each side on June 9. Along the north border, the level of the Big Marsh was slightly higher than that of the pond. The equation predicted a flux rate of 0.005 L/min per meter of shoreline. Multiplying by the length of the shoreline (105 m) gave a flux of 0.5 L/min. The fluxes predicted by the equation for the south, east, and west boundaries were -0.124, 0.4, and 0.004 L/min per meter of shoreline respectively. Multiplying these by the length of the respective shorelines gave flux rates of -13, 50, and 0.5 L/min respectively. Combining the flux rates for each boundary gave a net ground water flux into the pond of 38 L/min.

The calculated flux rate out of the pond was 3637 L/min and the calculated flux rate into the pond was only 38 L/min, making the rate out of the pond 96 times higher than the rate in. The error may lie in the value of the hydraulic conductivity of the surface fill material. The calculated hydraulic conductivity of 5.9×10^{-4} cm/s from the slug tests of MW-2 is most likely too low to be used for the fill material. Monitoring well MW-2 is screened in the silty/sandy glacial till underlying the fill material. However, the water flowing into the pond flows predominantly through the fill material, which contains an extensive macropore system. The hydraulic conductivity of the fill material could easily be in the range of 6×10^{-2} cm/s and may possibly be even higher in some areas. Using this value for a hydraulic conductivity in the Dupuit-Forcheimer equation would predict a net ground water flux rate equal to the calculated flux taken out of the pond.

To investigate this idea, slug tests were performed on several shallow piezometers around the pond on July 5, 1994 (P-2C, P-8C, and P-9C). In addition, piezometer P-8A was tested (it is seated in the silty, sandy clay) in order to see if the measured conductivity is much less than that of the shallow piezometers.

The piezometers were affixed with a water level recorder set to record the levels every ten seconds. A one-liter volume of water was added to the piezometer and the water level was monitored until the level had recovered to its initial value. The data from the tests was analyzed using the Hvorslev (1951) method. The calculated hydraulic conductivities range from 1×10^{-3} cm/s for P-8A to 7×10^{-3} cm/s for P-8C. The results of the analysis are not very reliable due to some complications in using the method:

- 1) To use the Hvorslev method, the screened length of the piezometer must be over eight times greater than the radius of the piezometer. The screens of the piezometers are just eight holes drilled along the bottom, making the screened length approximately 4-5 centimeters, while the radius of the piezometers is 1.7 cm. Because of this, the Hvorslev method may not be appropriate to analyze the data.

- 2) The graphs of the natural logarithm of the normalized drawdown vs time were not straight lines, having high slopes at early times and shallow slopes at later times. This suggests that much of the water added during the tests was lost in the early stages. This is consistent with flow through macropores, in which water will flow through the macropores when the hydraulic gradient is high, and as the gradient decreases, the water will flow through the smaller pores.

An added error was introduced by the rapid dissipation of the initial slug before the first measurement was taken. The inside diameter of the piezometers is 3.4 cm. Therefore, a one liter volume of water should have produced a rise in the water table of 1.1 meter. However, in each case, some of the volume added was lost within the first ten seconds (when the first measurement was taken). The recorded rises in the water table were: 0.91 m (83% of maximum) for P-2C, 1.03 m (94%) for P-8A, 0.80 m (73%) for P-8C, and 0.84 m (76%) for P-9C. The height of the rise in the water table is inversely proportional to the hydraulic conductivity; the higher the

rise, the lower the conductivity. Because the rise in P-8A was the highest, the hydraulic conductivity should be the lowest. This is expected since the piezometer is set in silty, sandy clay. The rise in P-2C was the next highest. Therefore, the conductivity should be higher than that of P-8A. This is also expected since this piezometer is set in the upper part of the silty, sandy clay, near the interface with the fill material. Approximately 25% of the water added to piezometers P-8C and P-9C was dissipated within the first 10 seconds. These piezometers are set in the fill material. This suggests that the hydraulic conductivity of the fill material is very high.

The combined affect of the above complications in the data analysis of the slug tests is that the calculated hydraulic conductivities are lower than the actual values by probably one order of magnitude or more. If the water levels were measured at 1-second intervals, the initial loss of the volume added would have been observed and the steep sections of the drawdown curves would have been more accurately indicated. The calculated conductivities would therefore have been closer to the actual values. Raising the calculated values by one order of magnitude would put them in the range needed to balance the water budget equation.

VI. DISCUSSION

The interactions between the shallow ground water and the ponds are influenced by precipitation, both seasonal and event-based. Water levels and precipitation were monitored during the nine month period from September 1993 to June 1994 using piezometers, wells, seepage meters, and recording rain gauges.

The hydraulic gradient in the area is generally low, which produces a relatively flat water table. Shallow ground water flow on the site has been found to be to the west toward Lake Calumet. The ground water flows through a layer of fill material 2-3 m thick which lies above glacial lacustrine and glacial till deposits. The minerals contained in the fill are dissolved by the ground water and re-precipitate as the ground water discharges along the eastern borders of ponds B and C. Along these borders, the surface of the fill material drops very quickly toward the ponds, causing the hydraulic gradient to increase quickly, and thus forcing the ground water flow to have a vertical component.

The erratic nature of the surface fill material has apparently caused extensive macropore systems to develop. These preferential pathways cause the fill material to have a hydraulic conductivity which may be two orders of magnitude or more greater than the underlying deposits, based on the results of a water budget analysis of pond B. The large hydraulic gradient along the eastern borders of ponds B and C, in conjunction with the existence of the macropore systems, causes springs to appear along the shore with a regular spacing from 12-20 m. The discharge from these springs varies spatially and fluctuates with precipitation, hence contributing to the spatial variability in the seepage rates to the ponds.

After precipitation events, a small, short-lived reverse flow cell occurs in the southwest corner of pond A. The reverse seepage back into the pond forces ground water flowing out of the pond to exit at points further north along the border. This leads to higher outward seepage rates in the northwest corner of the pond.

The lag time in the response of the water table to precipitation is associated with the infiltration of water down to the saturated zone. The monitoring of three individual precipitation events has revealed that the lag time ranges between 6.5 hours and 16 hours, and is inversely proportional to the moisture content of the unsaturated zone prior to the events.

The magnitude of water table fluctuations are not only a function of precipitation, but also are directly proportional to the distance from the ponds. This suggests that a large volume of water discharges to the ponds during and after rain events.

In the individual ponds, the magnitude of fluctuations in the water level also seems to be related to the primary type of pond each one is, either a ground water recharge or discharge pond. The discharge ponds have higher magnitude fluctuations due to water discharging into the pond long after an individual precipitation event has ended.

The data from the use of water level recorders has provided information to answer the question as to how often water levels should be measured in order to accurately model the fluctuations, since the monitoring period of water levels could have a large affect on a ground water flow or contaminant transport model. The data suggest that monthly monitoring is sufficient for long term studies, even though the larger time periods tend to attenuate highs and lows in the water levels. For shorter term studies, the fluctuations caused by individual rain events will only be observed by shorter monitoring periods, such as bi-monthly or less depending on the data resolution required.

VII. RECOMMENDATIONS FOR FUTURE WORK

The results of this project suggest several areas for future research. These areas will be important to gain a more complete understanding of the interactions between the wetlands and the shallow ground water, especially since plans have been made for the site to become a state conservation area. Some of the areas to be considered include:

- 1) The stratigraphy of the surface fill layer has a major influence on the interactions between the shallow ground water and the ponds. A more detailed hydrologic analysis of the material is needed to answer questions relating to flow rates and volumes. This information would be required in any numerical modelling study of the shallow ground water flow on the site.

- 2) The current research has indicated that a complex macropore system exists in the surface fill material which accommodates a large volume of the shallow ground water flow. Also, the lag time has been shown to be dependent on the moisture content of the unsaturated zone. These two factors indicate that a more thorough knowledge of the mechanics of the flow through the unsaturated zone is needed.

- 3) The role of evapo-transpiration on the level of the ponds should be researched, since the current project has shown that the level of pond A fluctuates daily, and that evaporation may not be the only cause of the fluctuations.

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APPENDIX F
RESPONSE TO COMMENTS

**CHICAGO/INTERLAKE SITE
RESPONSE TO IEPA COMMENTS ON THE
FEBRUARY 1996 SUMMARY REPORT AND
SUPPLEMENTAL WORK PLAN (SR/SWP)**

September 20, 1996

1. Section 1.3.1, Topography and Surface Water Drainage, pages 1-3 and 1-4, indicates the point of entry and exit of Indian Treaty Creek are blocked to near full depth with railroad ties and sediment that block flows into and out of the Site. Please provide a detailed discussion to include whether Waste Management intends to remove any of the referenced blockages and conduct an investigation into the source of contamination entering the Site via Indian Treaty Creek, including sediment sampling along the creek.

Based upon the meeting between IEPA and WMII on August 22, 1996, WMII has decided that future investigation and potential remediation activities to be conducted by WMII will be focused on the southwest portion of the property, and will exclude surface water, sediment, and regional groundwater concerns. WMII intends to pursue a No Further Action (NFA) letter from IEPA only with respect to remediation of the southwestern portion of the property (refer to area delineated on Figure 2). At this time, WMII does not intend to remove the railroad ties or conduct an investigation to examine possible off-site sources.

2. Section 1.3.2, Geology, page 1-4, second paragraph, first sentence does not state how thick the unmined sand layer is or provide its location. This statement should be revised to refer to either a well log or cross-section (not presently in SR/WP) that provides this information.

The text has been revised to include a description of the thickness and lateral distribution of the unmined sand layer by reference to geologic cross-sections presented in "Hydrogeologic Investigation, Interlake Site, Chicago, Illinois," Canonic Environmental, 1982.

3. Section 1.3.2, Hydrogeology, page 1-4, second paragraph, fifth sentence, refers to the stratified drifts on-site as seldom yielding large amounts of water. This sentence should be revised to indicate numerical values the referenced stratified drifts will yield.

Canonic (1982) reported in-field hydraulic conductivity values calculated from test borings drilled at the site in the Tinley and Valparaiso tills at 9×10^{-8} and 9×10^{-9} cm/sec respectively. Duwal (1989, Appendix E) calculated an in-situ hydraulic conductivity of 5.9×10^{-4} from a falling head test done on groundwater monitoring well MW-2 installed in the glacial till at the site. Although well yields were not specifically reported in either investigation, the well yields corresponding to hydraulic conductivity values in this range are anticipated to be low. The text was revised to include this information.

4. Section 1.3.3, Hydrogeology, page 1-4, second paragraph, first sentence, states that shallow groundwater in the unexcavated sands and fill flows west-southwest toward Lake Calumet. This sentence should address an estimated rate of flow of the shallow groundwater toward Lake Calumet.

The rate of flow of the groundwater was not reported for the unexcavated sands and fill in the Canonie (1982) or the Duwal (1989) reports, however, Duwal states that "the velocity of the groundwater flow is usually very slow, on the order of less than a meter per day." Duwal also describes the possibility that the heterogeneous nature of the fill may provide conditions for preferential flow paths in the fill where the flow velocity is higher. The text has been modified to include this information.

5. Section 1.3.3, Hydrogeology, page 1-4, second paragraph, third sentence, states that due to the flat horizontal gradient and lack of a vertical gradient, groundwater flow in the central area of the Site is almost stagnant. This sentence should be revised to include the boundaries of the central area referred to, whether this area includes the Big Marsh, whether the surface water in this area of the Site is in communication with or recharges the groundwater by runoff following rain events, and what is meant by almost stagnant.

The text has been revised to delete the reference to a central area. The conclusions of Duwal's (1989) work on the effect of rain events on surface water to groundwater interaction have been added. Duwal's thesis is included in Appendix E. The reference to almost stagnant has been deleted and modified to indicate that the groundwater flow velocity is slow rather than "almost stagnant."

6. Section 1.3.3, Hydrogeology, page 1-4, third paragraph, third sentence, indicates a direct relationship between surface water and groundwater levels at the Site. Even though this is the only place in the SR/WP that refers to a relationship between surface waters and groundwater, Waste Management should determine if this relationship exists throughout the Site.

Please refer to Appendix E which includes Duwal's 1989 thesis report. The text has been revised to summarize the conclusions of Duwal's 1989 report which describes the effects of precipitation on surface to groundwater interactions at the site. Although it focused primarily on one area, Duwal's investigation involved the entire site.

7. Section 2.1.1, Groundwater Sampling Results, page 2-2, first paragraph, fifth sentence refers to benzene detections in the 1989 groundwater sampling, but the analytical results for July 1989 contained in Appendix A of the SR/WP appear to be for CID Landfill and the results show no detects for any constituents. The data referred to in the text is included in Table 3, but not in Appendix A. Please address this apparent discrepancy and re-submit.

Benzene was not detected in any of the groundwater samples collected at the site in 1989. The text has been modified to clarify this. The groundwater sampling event conducted in 1989 was performed by Weston for IEPA with split samples for VOCs collected by WMII. Weston analyzed the samples for TCL VOCs, semi-volatiles, inorganics, and pesticides.

Weston's analytical results were not included in the original submittal. These results are now included in Appendix A along with WMII analytical results for the VOC analyses which were included in the original submittal. The reference to the CID landfill at the header of the WMII analytical report indicates that CID landfill coordinated the sampling, but the samples were collected at the Interlake site.

8. Section 2.1.1, Groundwater Sampling Results, page 2-2, second paragraph, second sentence, refers to Bis-2-ethyhexylphthalate (BEHP) as being detected in the July 1989 sampling event and the data is included in Table 3, but is not included in Appendix A with the other groundwater analytical results. The only groundwater analytical results for the stated period is for the CID Landfill, not the above-referenced Site. Please address this apparent discrepancy and re-submit.

The BEHP, which was detected in SS-1D (G-105) at 9 ppb, was "J" coded and, therefore, represents an estimated value. Please see the response for Comment No. 7. Although the CID landfill is listed at the top of the analytical reports, this only indicates that CID landfill coordinated the sampling. The results are from sample splits for VOC analysis collected with WMII and Weston at the Interlake site.

9. Section 2.2, Surface Water Sampling Results, page 2-2, third paragraph, first sentence, states "No VOCs or SVOCs were detected in surface water samples at these locations at levels above the State of Illinois Water Quality Standards for Wildlife (Appendix D)." There are no State water quality standards specifically for wildlife. However, since approximately 87 acres of the central portion of the Site have been designated as a wetland by the U.S. Army Corps of Engineers Special Area Management Plan for the Lake Calumet Region, the groundwater underlying the marshes may qualify as a Class III Special Resources Groundwater. The definition of a Class III groundwater may be found in 35 Ill. Adm. Code, Illinois Groundwater Quality Standards, Section 620.230, and refers to discharges to a vital wetland.

Based upon the meeting between IEPA and WMII on August 22, 1996, WMII has decided that future investigation and potential remediation activities to be conducted by WMII will be focused on the southwestern portion of the property, and will exclude surface water, sediment, and regional groundwater concerns. WMII intends to pursue a No Further Action (NFA) letter from IEPA only with respect to remediation of the southwestern portion of the property (refer to area delineated on Figure 2) which includes the "tar like" materials.

However, the text has been revised to delete the reference to Illinois Water Quality Standards for Wildlife and replace it with Class III Special Resources Groundwater.

10. Even though the marshes have been declared a wetland, contamination in the surface water must be reviewed in reference to Title 35: Environmental Protection, Subtitle C: Water Pollution, Chapter I, Subpart B, Sections 302.201 through 302.212 (copy enclosed). Numeric values may be obtained from the Agency's Bureau of Water for any parameters not listed under Section 302.308.

Please see the response to Comment 9.

11. 35 Ill. Admin. Code, Section 620.430, states that Class III groundwaters have to meet Class I standards, unless the Illinois Pollution Control Board were to grant an adjusted standard. In addition, Indian Treaty Creek appears to carry contaminants onto the Site and has an apparent communication with the wetland surface area and the surface water is in communication with the underlying groundwater. Please provide a detailed discussion of the apparent communication patterns that exists between surface water and groundwater beneath the entire site.

Please see the response to Comment Nos. 5 and 6. WMII concurs that there is evidence that off-site sources are contributing to the contamination of the Interlake property.

12. In addition to providing a discussion on the communication patterns of surface waters and groundwater at the Site, Waste Management should consider secondary contact and indigenous aquatic life standards under Title 35, Subtitle C, Subpart D: Sections 302.401 and following. This is not to exclude the potential impact on a non-aquatic wildlife that feed and nest in the wetlands and a human population known to fish from the southern portion of the Big Marsh on the western edge of the property off Stony Island Avenue.

Please see the response to Comment No. 1.

13. Section 2.3, Soil and Sediment Sampling Results, page 2-3, second paragraph, ninth sentence, states "It is WMII's and Rust's opinion that if any of these samples had been tested to using TCLP testing methods, the results would have shown that the TCLP cyanide concentrations are below the IEPA's Soil Remediation Objectives." Unless TCLP testing methods are conducted for samples, it cannot be opinioned that resultant concentrations would be below this level. In addition, the only analytical results included in the SR/WP in Appendix C are for sediment samples analyzed for total and reactive cyanide. In addition, these same results are included in Appendix B (Surface Water Sampling Results), which brings into question the credibility of the SR/WP results. Since the cited analytical data may not directly relate to present day conditions, the Agency recommends that Waste Management re-sample on-site soil and sediment and collect additional sediment samples from Indian Treaty Creek prior to its entering the Site and upon its exit for constituents on the Agency's Target Compound List (TCL). A copy of the TCL is enclosed for your reference.

The reference to an opinion on the probable results of TCLP testing was deleted. However, a modification to the text describes a 20 times dilution factor of total metals analytical results which is inherent in the TCLP procedure (the soil is leached with 2 liters of liquid). Assuming complete leaching occurs during the TCLP procedure so that all of the contaminant in the solid leaches into the liquid, the solid concentration will be diluted by a factor of 20 in the resulting liquid. Incomplete leaching would result only in a lower concentration in the liquid. Therefore, it is logical to assume that TCLP results would be lower than the concentration of total metals in the soil and sediment.

The same set of analytical results from WMII's 1994 sampling event are included in both Appendix B and C because the analysis report includes both sediment and surface water analytical results. The sample identifiers for both sediment and surface water samples begin with "SW." The headers of the laboratory reports indicate the media type.

In consideration of the response to Comment No. 1, sediment and surface water will not be resampled. At this time, WMII will address the soil and groundwater in the southwestern portion of the site (please refer to the area delineated on Figure 2 which includes the "tar like" materials). As described in the SR/WP Section 3.2.4, one composite sample collected from up to six test pits will be analyzed for waste disposal characterization.

14. Section 2.3., Soil and Sediment Sampling Results, page 2-3, third paragraph, states that "Ten SVOCs detected in soil and sediment samples collected during the USEPA SSI. With the exception of benzo (a) anthracene, chrysene, and benzo (k) fluoranthene, these SVOC concentrations are within orders of magnitude of the IEPA's Soil Remediation Objectives. Additionally, as these measurements of SVOC concentrations are over 6 years old, it would be reasonable to expect that the SVOC exceedences no longer exist." While the detected SVOCs may have biodegraded over 6 years, to state that they no longer exist is not reasonable. Further, the only analytical results included in the SR/WP in Appendix C are for sediment samples analyzed for total and reactive cyanide. In addition, these same results are included in Appendix B (Surface Water Sampling Results), which brings into question the credibility of the SR/WP results. Since the cited analytical data may not directly relate to present day conditions, the Agency recommends that Waste Management re-sample on-site sediments and soils and collect additional sediment samples from Indian Treaty Creek prior to its entering the Site and upon its exit for constituents of the Agency's TCL.

Please refer to the response to Comment No. 13. The text has been edited to indicate that biodegradation may have lowered these SVOC concentrations over the last 6 years to levels which may no longer exceed regulatory threshold values.

15. Section 2.3, Soil and Sediment Sampling Results, page 2-4, second paragraph, second sentence, refers to IEPA Soil Remediation Objectives as being contained in Appendix D. The Agency is proposing the enclosed 742 Rules and this document may be referred to in future submittals regarding on-site remediation or remedial activities.

We acknowledge that the proposed 742 rules ("Tiered Approach to Cleanup Objectives" or TACO) are applicable to soils and groundwater at this site. The text has been revised to reference the proposed 742 rules and Appendix D now contains a copy of the proposed rule.

16. Section 2.4, Geophysical Testing, page 2-4, second paragraph, second sentence, refers to elevated levels of benzene being detected in oily slag samples in a test pit Area A, but does not provide or reference where the analytical results are reported in the SR/WP. Please correct this apparent discrepancy and re-submit.

The reference to an oily slag sample with elevated levels of benzene is from Integrated Sites, 1991 Work Plan. A TCLP analysis of white material collected from one test pit in Area "A" in 1991 resulted in a benzene concentration of 2.8 mg/l which is above the soil cleanup standard of 0.5 mg/l. This information was added to the text.

17. Section 2.4, Geophysical Testing, page 2-4, third paragraph, refers to tar being detected in test pits in Area B, but does not indicate the concentrations of the constituents of the tar and Figure 2 does not include a direct reference to the location of the tar pit. Please revise this paragraph to reference Section 3.2.2, your recommendation of future activities regarding this portion of the Site.

The test pits were primarily excavated for the purpose of producing a visual log of the subsurface materials in the areas of geophysical anomalies. Samples of all types of the subsurface material were not submitted for laboratory analysis. The descriptions of tar are qualitative and are based upon visual observations performed as the excavations proceeded.

The distribution of tar in the test pits is described in the text of the 1991 Integrated Sites Work plan by reference to Figure 2.

A reference to Section 3.2.4, Investigation of "Tar Like" Materials, was added to describe the proposed future investigative activities in this area.

18. Section 3.1.1, Groundwater, page 3-1, second paragraph, second and third sentences, stated that "As shown in Table 3, exceedences of IEPA groundwater standards are due to contaminated groundwater entering the Site. Therefore, it is WMII's opinion that past activities at the Site have not impacted the Site's groundwater." The Illinois Pollution Control Board developed and promulgated existing groundwater standards, not the IEPA. In addition, it has not been demonstrated with certainty that the sole source of contamination of the Site's groundwater is linked to groundwater entering the Site and not related to past Site activities. It should be noted that since a tar pit was left on-site from past Site activities and tar was noted in five of nine test pits in Area B. Further, the horizontal and vertical extent of contamination at the Site has not been determined, and there is an apparent hydraulic connection between the surface (soil, sediment, and/or marshes). According to Figure 2, insufficient data was collected in the vicinity of the tar pit area, since the only sampling point was the 1982 surface water sample No. 6. Since the groundwater data is at least 5 years old, the Agency recommends that the Site groundwater contaminant levels be re-evaluated and Waste Management consider installing a monitoring well in the vicinity of the tar pit.

To address the potential impact of the tar pit area on the groundwater in the southwest corner of the site, an additional water table groundwater monitoring well will be installed approximately 200 to 300 feet north of ST-4S and D nest, developed and sampled bi-annually for 1 year (for a total of two sample rounds) along with other groundwater monitoring wells identified in the response to Comment No. 21. The text of Section 3.2.1 and Table 6 is edited to include this information.

19. Table 3 data for July 1, 1989, is not supported by analytical results in Appendix A. Data reports in Appendix A shows the Site name as CID Landfill at 138th and Calumet Expressway and contain only the depth to groundwater and well elevations. All analytical results are shown as no detects. Please correct this apparent discrepancy and re-submit.

Please refer to the responses for Comments Nos. 7 and 8.

20. Section 3.1.2, Surface Water, page 3-1, first paragraph, states "Based on the IEPA's Water Quality Standards for Wildlife, concentrations of inorganic compounds have been exceeded in the Site Surface Waters." Please refer to Comment No. 9 above regarding the non-existence of standards for wildlife.

Please see the response to Comment No. 9. The reference to standards for wildlife has been deleted.

21. Section 3.2.1, Groundwater Monitoring, indicates that Waste Management proposes to collect one supplemental round of samples from existing monitoring wells in an effort to characterize existing conditions. While the Agency concurs with your proposal to collect additional groundwater samples, we do not believe that additional sampling should be limited to just one round. To account for seasonal and area fluctuations in groundwater levels, a minimum of four rounds should be collected and analyzed for compounds on the Agency's TCL.

WMII proposes to collect two rounds of groundwater samples approximately 6 months apart for analysis of IEPA's target compound list (TCL) of parameters. Any compounds not detected in Round 1 will be deleted from the analyte list for Round 2. If an analysis of a groundwater sample collected from a well during Round 1 results in all nondetects, the well will not be resampled for Round 2. The wells proposed for sampling are located in the southwestern portion of the property and include ST-1S and D, B-19S, B-17S, B-26S, and ST-4S and D, and one new groundwater monitoring well to be installed 200 to 300 feet north of the ST-4S and D nest for a total of eight wells. The text was revised to modify the list of proposed groundwater monitoring wells to include the wells located up and downgradient of the southwestern portion of the site. This should be sufficient to characterize the groundwater quality at this location.

Seasonal groundwater and surface water data were collected for Duwal's 1989 investigation of the effects of precipitation on surface water to groundwater interactions at the site. This data will be evaluated to select the month for sampling which is most likely to represent the high water table condition. The second sampling event will be 6 months from this initial sample. By this method, two rounds of groundwater sampling can be used to account for potential changes in groundwater quality related to any seasonal fluctuations in the water table.

22. It has been the Agency's experience that monitoring wells left unused for lengthy periods will lose their integrity and produce less than reliable data and since the monitoring wells were installed in 1982, 14 years ago, the Agency is concerned that any data collected from the

Sampling proposed in the submitted SR/WP will be in question. The Agency recommends that Waste Management verify the usefulness of the existing wells as sampling points prior to initiating proposed site activities and replace any damaged wells as needed.

We agree with the need for a well integrity survey. However, given WMII's focus on the southwest portion of the property (see response to Comment No. 1), only wells in this vicinity will be included in that survey (ST-1S and D, B-19S, B-17S, B-26S, and ST-4S and D, and one new groundwater monitoring well installed 200 to 300 feet north of the ST-4S and D nest for a total of eight wells. The results of the well integrity survey will determine which wells need to be abandoned and/or replaced. This information has been added to Section 3.2.1 of the text.

23. Figure 3 appears to represent the structure of the surface of bedrock and does not represent the slope of the deep, potentially confined aquifer. The figure should be revised using the hydraulic heads of all existing reliable monitoring wells to reflect the potentiometric surface of the bedrock aquifer. To provide sufficient points of water level measurements and an adequate picture of flow from the landfill areas, the southern, eastern, and western boundaries of the Site, the Agency recommends that Waste Management install additional deep monitoring wells a minimum of 200 feet apart. This effort will also provide additional analytical data to support Waste Management's contention that the Site has minimal contamination.

Figure 3 was incorrect in the SR/SWP. An inferred top of bedrock contour map produced by Canonic (1982) was inadvertently submitted as the piezometric surface map of the bedrock aquifer. Figure 3 now correctly shows the piezometric surface map of the bedrock aquifer. The piezometric map was developed by Canonic (1982) from groundwater elevations measured in wells installed in the bedrock below the unconsolidated deposits across the site. The map depicts the gradient and flow direction within the confined bedrock aquifer.

The bedrock piezometers currently have a historical water quality database. As described in Section 2.1.1, groundwater samples collected in 1989 (IEPA) and 1982 (Canonic) from wells installed in the unconsolidated deposits and within the Silurian dolomite bedrock beneath the site did not exhibit contamination above regulatory thresholds. Contaminants detected were attributed to contamination of the drilling fluid (benzene, Canonic, 1982) and upgradient off-site sources (acetone, IEPA, 1989). Cravens and Zahn (1990) sampled one bedrock well on-site as part of a water quality study performed by the Illinois State Water Survey for the Lake Calumet area. No contaminants were detected in this groundwater sample. One of the conclusions of this report for the Lake Calumet area was:

"Although inorganic and organic contaminants have been detected in a few samples from the Silurian dolomite aquifer in both water-supply wells and monitoring wells, the contamination is not attributable to natural ground-water transport through geologic materials overlying the bedrock aquifer."

The reason given for not attributing the contamination detected in the off-site bedrock wells in the Lake Calumet area to contamination of the groundwater present in the unconsolidated deposits above the dolomite aquifer was the presence of the thick till sheets which overlie the bedrock. Scattered instances of contamination detected in off-site bedrock wells in the Lake Calumet area were attributed to cases where man-made breaches in the till sheets allowed access to the bedrock. Since the Tinley and Valparaiso tills are intact at the site, they are a natural barrier to flow into the deeper bedrock unit. Field hydraulic conductivity testing performed by Canonie (1982) indicated low permeabilities for these two tills (9×10^{-8} and 9×10^{-9} cm/sec, respectively). These low hydraulic conductivity values provide further indication of the confining properties of the tills overlying the Silurian bedrock at the site.

24. Appendix A does not contain analytical data from all groundwater monitoring wells (e.g., B-8M, B-26S, etc.). Please verify whether these monitoring points exist and if so, they may provide missing analytical and groundwater elevation data for the shallow aquifer. If these points no longer exist, the Agency recommends that Waste Management consider re-establishing them and include them in your groundwater monitoring program.

Please see the response to Comment No. 22.

25. If the only monitoring points used to draw the potentiometric map in Figure 4 were shallow wells ST-1S, ST-2S, ST-3S, and ST-4S, then there are too few points to provide the necessary information to adequately represent the direction of flow in the shallow aquifer. The Agency recommends that Waste Management install additional shallow groundwater monitoring wells and/or repositioned existing wells to be directly down gradient of the landfill areas.

Groundwater monitoring wells ST-1S, ST-2S, ST-3S, ST-4S, and B17S, B19S, B-22S, B-23S, and B-26S were used to develop the water table map presented in Figure 4. Because of the flat water table gradient at the site, the nine wells listed are sufficient to develop the water table map. Please refer to the responses to comments Nos. 1 and 21 for the reasons why certain wells were selected for future groundwater monitoring.

26. The July 12, 1991, analytical results for the Site's shallow groundwater monitoring wells contained in Appendix B (labeled Surface Water Sampling Analytical Results) indicate that on-site groundwater can exhibit a pH in the range of 7.4 to 12.3, which appears to be leaning to the basic side. The revised work plan should include a discussion of the possible impacts a basic groundwater may have on a future corrective action for the Site.

We believe that the unusually high pH range (up to 12.3) is due to inaccurate field measurements. The results from the proposed sampling program will provide data to further evaluate this potential issue.

27. All sample analyses should be conducted and data quality confirmed in accordance with the Agency's Analytical Quality Assurance Plan (copy enclosed).

Acknowledged.